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MODERN JUNIOR MATHEMATICS
BOOK : : : : ONE

MARIE GUGLE

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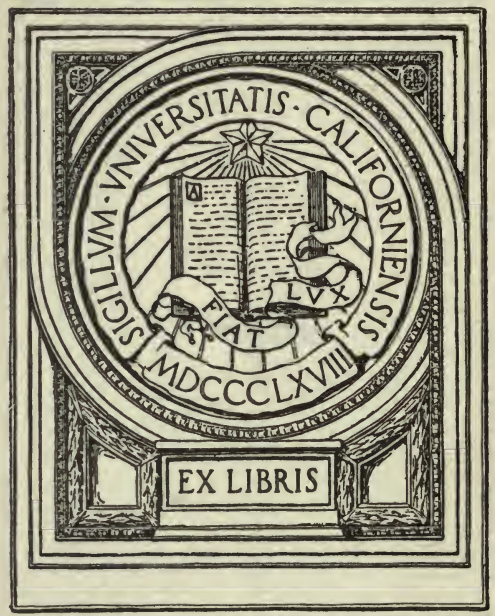

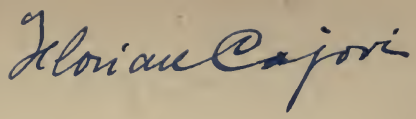

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MODERN JUNIOR MATHEMATICS

BOOK ONE

BY

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COLUMBUS, OHIO

UNIV. OF CALIFORNIA

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PREFACE

Until recently upper elementary and high school work in mathematics was planned for the pupil who was expected to continue it in the university. Although logical, its arrangement was neither psychological nor pedagogical. Some progress, however, has been made recently in adapting the study to the needs and abilities of pupils.

In the junior high or intermediate school, work in mathematics in the seventh, eighth, and ninth grades should be complete in itself and at the same time preparatory to senior high school work. No effort should be made to "finish" arithmetic in the eighth grade and algebra in the ninth, while denying the child the interest and beauty that lie in geometry and trigonometry until his taste for mathematics has been destroyed. Nor will alternate bits of formal algebra, geometry, and trigonometry solve the problem. The result is a mastery of none and a confusion in all.

Experience has proved that the necessary elements of arithmetic can be taught and certain definite skill developed in the first six grades. In the seventh grade business applications of arithmetic with the simplest elements of bookkeeping should be given. In the eighth grade mensuration should be taught experimentally or through observational geometry, and, through that, in a natural and meaningful way,

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the very beginnings of algebra. Optional courses should be offered in the ninth grade.

Experience has shown that much of the content and the whole of the subject matter must be changed to make the course of study fit the needs of the pupils.

The definite aims of Book One of this series are:

1. To train the pupil in that part of arithmetic used in everyday business which he can understand.
2. To develop his skill in rapid calculation by short cuts and time tests.
3. To show the necessity for checking, and to develop the habit of checking.
4. To develop the habit of thrift by planning budgets, keeping accounts, and becoming familiar with savings banks.
5. To train the pupil in the simplest elements of bookkeeping.
6. To study a few common applications of arithmetic for their social and economic value more than for their mathematical content.

In presenting each phase of the subject, actual business practice has been carefully followed. For this reason the terms base, rate, and percentage are not used.

The whole subject of percentage is closely interwoven with the already familiar fractions. The various applications are not presented as new mathematical topics, but as new uses in business of the same arithmetic.

The various methods of calculating interest are omitted, for they are not used in business and serve only to confuse the pupil. The general method is

given in order that he may thoroughly understand the principle of interest; then interest tables are presented, so that he may know business practice.

The usual work in bank discount is omitted because it rightly belongs in a high school arithmetic. In the child's relation to a bank he needs to know how to open an account; how to make checks and keep stubs; how to indorse checks and fill out deposit slips; and how money works for him if put in a savings bank. These things are given, as are other phases of social and business practice, but only those for which a child can feel a need or can see a need in his near future.

A sane and practical pedagogy has been consistently followed. First, the use is shown; then, a feeling of the need is created as a motive for learning; and finally, the topic is developed in a simple, natural way, with sufficient applications and practice to give the pupil a sense of mastery.

The graph is given, not in an isolated chapter to be taught or not as the teacher wishes, but it is used throughout to illuminate different phases of the subject. That is, mathematical language is given more meaning by the use of graphs or mathematical pictures, just as the English or a foreign language is made more interesting and more intelligible by illustrative pictures.

Book One of the series is planned for a year's work in the seventh grade, or the first year of the junior high or intermediate school, and will follow in unbroken sequence the sixth grade work of any standard arithmetic series.

The author gratefully acknowledges the assistance given by Miss Amy Preston, a teacher of junior high school mathematics, for her valuable help, especially in connection with the bookkeeping.

Appreciation is due also to Mr. B. D. Postle, a teacher of bookkeeping in the junior high school, for his helpful suggestions; to Mr. George Mock of the Ohio National Bank of Columbus, Ohio; to Miss Sophie Gross of the Sophie Gross Millinery Shop, Columbus, Ohio; and to others for the courtesies shown in supplying illustrative material.

MARIE GUGLE

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SUGGESTIONS TO TEACHERS

OF

MODERN JUNIOR MATHEMATICS

COURSE IN ELEMENTARY MATHEMATICS

Scope of the Course.—This series is designed to give the student a practical working knowledge of the fundamentals of elementary mathematics, including arithmetic, intuitive geometry, algebra, and numerical trigonometry. These various phases are not taught as separate and distinct subjects, but are fused into a course of general mathematics, which keeps their relationship and interdependence in evidence.

Scope of Chapter One.—The first chapter is designed to develop: (1) a genuine skill in accurate rapid calculation with integers and fractions in actual use, both common and decimal; (2) a knowledge of everyday arithmetic in business, including a facility in its methods and processes and an appreciation of their social or civic values; (3) a knowledge of the necessary records in business or the elements of bookkeeping used in personal and business accounts.

In presenting each phase of the subject, actual business practice has been carefully followed.

BOOK ONE

CHAPTER ONE

ACCURATE RAPID CALCULATION

Aims.—The definite aims of Chapter One of Book One are:

1. To help the pupil to realize the absolute necessity of accuracy in arithmetic calculations.
2. To give him methods of checking results so that he may know for himself that his work is correct, and to develop in him the habit of checking.
3. To make him familiar with a reasonable number of short cuts in multiplication and division with integers and fractions, both common and decimal. These short cuts not only save time in making calculations but often give a better insight into mathematical relationships. The ability to see mathematical relationships is more important than merely obtaining a result in calculation.
4. To enable the pupil to express mathematical relations as mathematical pictures by the use of line graphs and bar graphs.

Directions for Study.—Specific directions are given in the text with the various exercises. These should be followed carefully. The pupil should remember that speed and accuracy in addition, for example, are not developed by adding long columns of large numbers. These abilities come from continued practice with numbers from 0 to 100, which include all the addition combinations. No better drill in addition and subtraction has been devised than by beginning with various digits and counting by 3's, 4's, and other

digits, and the reverse process of beginning at 100, 99, 98, 97,—91 and counting backward by 3's, 4's, 5's,—9's. Such exercises should be used for ten minutes' daily practice.

Accuracy of calculation should be a permanent habit, developed largely through checking. Excessive speed in calculation is a temporary skill, easily lost through lack of use and readily regained by practice.

Attention is directed to the fact that the text uses only those fractions that have small denominators. Fractions with large denominators are found in some arithmetics, but are not used in business practice. Such fractions should always be expressed in decimal form. Their introduction in the class room in the common fraction form should be avoided, for they serve only to confuse.

In all calculations, especially in multiplication and division, the pupil should develop the habit of making estimates of the results by using round numbers. Such estimates serve as checks on the work and prevent absurdly small or absurdly large results.

CHAPTER TWO

EVERYDAY ARITHMETIC IN BUSINESS

Aims.—The definite aims of Chapter Two of Book One are:

1. To train the pupil in that part of arithmetic used in business which he can understand and use.
2. To give him a knowledge of business practice in such matters as making sales slips, monthly statements, and receipts.

3. To teach him the use of money and banks in business, and the opening of a bank account, including the making of deposit slips, filling out checks and stubs, and endorsing checks.
4. To show him how profits are measured and the advantages of using per cent, in making all comparisons of measurements.
5. To train him in habits of thrift by making budgets.
6. To give him an understanding of such business terms as cost of doing business, depreciation, discounts, wholesale and retail selling, and commission.
7. To give the pupil an understanding of the necessary business practice of borrowing money; a knowledge of favorable and unfavorable conditions for borrowing or lending money, of how money works, and of legitimate investments and hazardous risks.
8. To give him an idea of how the interest varies with any one of three factors, the principal, the rate of interest, and the time of the loan, as well as a skill in calculating interest and in reading interest tables.
9. To develop the habit of thrift by giving a knowledge of savings banks and of compound interest.
10. To train the pupil in a proper civic attitude by giving him an understanding and appreciation of community privileges and needs and how they are paid for, as well as an ability to calculate taxes and insurance.

Directions for Study.—The whole subject of percentage should be studied, not as a new topic, but closely interwoven with the already familiar fractions, both common and decimal. The various applications are not presented as new mathematical topics, but as new uses in business of the same arithmetic.

In the study of percentage, the abstract terms, *base*, *rate* and *percentage*, are purposely avoided. These

terms are found only in formal arithmetics. They have no use in business practice. A business man may speak of the *cost*, or his *rate of* interest, or his *gain*, but he never uses the abstract term.

The usual work in bank discount is omitted, because it rightly belongs in an advanced text and comparatively few persons use it. But every one needs to know how to open a bank account; how to make checks and keep stubs; and how to endorse checks and fill out deposit slips. These things are given, as are other phases of social and business practice for which one has immediate need.

On page 65 are a number of questions on money and its value. The teacher should not be content with mere answers to these questions. Here is a real opportunity to start the pupils in thinking about some elementary economics. Several days may be spent on this page profitably. Let different members investigate different problems and discuss them before the class. They will be interested if given references to elementary economics, histories, and encyclopedias.

A sane and practical pedagogy has been consistently followed. First, the use is shown; then, a feeling of need is created as a motive for learning; and finally, the topic is developed in a simple, natural way, with sufficient applications and practice to give the pupil a sense of mastery.

The graph is given, not as an isolated chapter to be taught or not as the teacher wishes, but it is used throughout to illuminate different phases of the subject. That is, mathematical language is given more meaning by the use of graphs or mathematical pictures,

just as the English or a foreign language is made more interesting and more intelligible by illustrative pictures.

In all the calculations, be sure to use the short methods given in Chapter I. Remember that business demands absolute accuracy. A clerk's carelessness in placing a decimal point may cost a firm hundreds of dollars. To attain accuracy thorough checking is necessary. Form the habit and make it strong.

Mathematically, interest, taxes, and insurance are merely other business practices in which calculations are made in per cents. There are really no new mathematical processes in these topics.

Interest is taught from the social and economic point of view. The pupil should clearly understand the three variables upon which interest depends. This principle underlying the calculation of interest and the business practice of reading interest from tables should supplant the various antiquated methods of calculating interest. Teaching too many methods results in a mastery of none.

Compound interest is mathematically unimportant for young pupils. But as a means of teaching thrift, it is economically very important. It is essential in calculations of insurance companies such as annuities.

Taxes involve no new mathematics, but they offer a big opportunity to teach good citizenship. In a country like ours, it is necessary for every one to know what taxes are for and to be willing to pay his share. Many persons pay taxes, but few calculate them. Therefore, the social phase of this subject is far more important than its mathematics. The questions on pages 132 and

133 should be discussed, not merely answered. The questions asked refer chiefly to the uses of local taxes. The pupils should be led to consider privileges enjoyed by them, for which state and federal taxes must be paid.

CHAPTER THREE

NECESSARY RECORDS IN BUSINESS

Aims.—The definite aims of Chapter Three of Book One are:

1. To train the pupil in the simplest elements of bookkeeping. It is not the aim to make professional bookkeepers. The main purpose is to develop personal habits of thrift that come from businesslike methods of keeping account of one's receipts and expenditures.
2. To lay a foundation for later study of technical bookkeeping through a study of strictly correct forms and practices, though presented in a non-technical way. The bookkeeping given is very elementary. In amount and kind it is that which every one needs to know.

Directions for Study.—The rapid calculations and short cuts given in Chapter One should be reviewed and used constantly in the bookkeeping. Unless Chapter One functions in Chapter Three, its teaching was useless.

Good penmanship, neatness, orderliness, as well as accuracy and speed, are matters to receive attention in the bookkeeping. Pupils should be encouraged to make their own budgets and keep their own cash books, not for a lesson or two, but long enough to establish the habit permanently, if possible.

The work from page 149 on requires the use of journal and ledger paper. If necessary, the pupils may rule their own. Better results are obtained by using ruled paper. Nearly every supply store carries a very good quality of both kinds, bound in paper, to look like cash books and ledgers. These are no more expensive than ink tablet paper and are much more satistory. The pupils enjoy their work more when their books resemble those used in real business.

A complete record is given for a month's business of a grocer. The pupils should make this set of books, being guided by the questions given on page 151 et seq. They should not merely copy the models, but should use them as checks on their work. Each one should imagine himself the bookkeeper for Mr. Williams and write down the items of each day's business just as they occur. Following this sequence is highly important.

In bookkeeping it is necessary to make haste slowly. Every step should be thoroughly understood. All of this work should be done in the class room. If home work is desired, let it be a review of the rapid calculation in Chapter One.

In adding long columns in bookkeeping, as in the cash book, pupils should divide them into two or three sections and find the total sum from these partial sums. In banks and in general business practice, adding machines are always used. Facility in adding long columns of figures is no longer a real social need. Absolute accuracy in shorter columns is far more important. In all calculation 100% accuracy should be required.

Emphasize especially the order of posting given on page 161. It is necessary to develop the right habits from the beginning.

After the record of the first month's business of the grocer has been correctly made, the pupil should continue the record of the second month's business.

The next model is that for the first month's business of a milliner, doing business on a cash and credit basis. The various models of this record should be used as the one for the grocer, merely as a check.

The second problem is not the next month's business, for it would demand the use of the journal. Instead, the business of another milliner is given.

See Suggestions under Chapter Five.

CHAPTER FOUR

TESTS OF ACHIEVEMENT

Aims.—The definite aims of Chapter Four of Book One are:

1. To supply a comprehensive set of problems that cover the various types of work in the preceding chapters.
2. To determine by their use what real achievement the pupil has made in the previous study.

Directions for Study.—A pupil should be able to work these problems independently. By this means he should develop an assurance that he really knows how to do certain kinds of problems. Through such individual work, he should detect the types of problems, if any, which he has not yet mastered, in which he should have further study and practice.

CHAPTER FIVE

MENSURATION

Arithmetic has been one of the three R's so long, that everybody accepts it as one of the "fundamentals" of the elementary school. It is recognized that everyone has to do some "figuring"; therefore everybody should have reasonable skill in the so-called fundamental processes, including addition, subtraction, multiplication, and division of integers and simple fractions in both common and decimal form, with, perhaps, a little percentage.

It should be remembered that during the middle decades of the nineteenth century, the arithmetic classes were filled, not with children, but with adult pupils, whose more mature interest was whetted by the introduction of the puzzle type or catch problem and by more difficult topics, such as alligation, cube root, and partial payments. These and other similar topics were introduced solely because they appealed to the maturer interest of these over-age but not subnormal pupils. No one ever claimed that there was a universal need for these topics or that they were practical.

Gradually the school year was lengthened from three months to six, eight, and ten months. A sixth-grade child, today, eleven years of age, has spent sixty months in school, whereas his great grandfather, up to the age of twenty-one, had spent forty-five months or less in school. The present sixth-grade pupil has read vastly more books than his great grandfather did in his whole lifetime. Nevertheless, he is still immature and lack-

ing in the background of experience to such an extent that those topics introduced for the benefit of the adult pupil are no longer appropriate.

It has become necessary, therefore, to challenge the various topics, to find out why they should or should not be taught. As a result, many of the older topics have been replaced by others of more vital life interest. Yet the traditional idea remains that arithmetic is taught because it is so generally useful. By such a test, the one application of arithmetic that is most universally needed is that of keeping simple accounts. Lack of thrift is said to be one of our national vices. Schools are now required by law to teach thrift. Such teaching means little unless it is translated into a habit of thrift. The habit of thrift is best developed by the keeping of personal accounts.

The purpose of Chapter Three of Book One of Modern Junior Mathematics is to develop this civic and social virtue, the habit of thrift, through the teaching of a non-technical introduction to the elements of bookkeeping. It serves also as an exploratory course or guide for a few who thereby discover a desire to choose bookkeeping as a vocation. Its need is not limited to these few, but extends to the many, especially to those who must leave school early and who must learn to conserve their meager earnings. If use is a criterion for selection, then this topic stands first, for it is the one way in which, in later life, every one must use his knowledge of arithmetic.

Every pupil should have some training in this valuable application of arithmetic. However, some schools may prefer to give only a part of the work of Chapter

Three. For such schools Chapter Five is offered as an alternative.

Many schools, or the more capable pupils in the schools, will find it possible to cover the work of both chapters.

Mensuration has long been recognized as a practical use of arithmetic and a topic suitable for seventh and eighth grades. Chapter Five gives an introduction to the mensuration or observational geometry of Book Two.

THE AUTHOR

MODERN JUNIOR MATHEMATICS

BOOK ONE

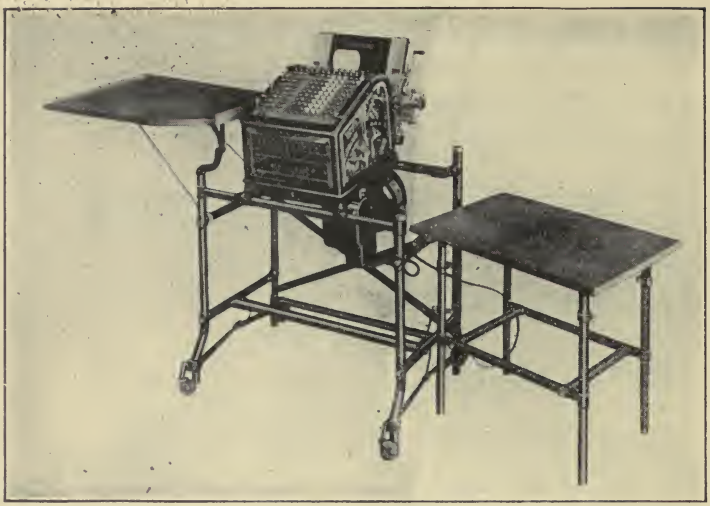
CHAPTER ONE

ACCURATE RAPID CALCULATION

A. WHAT EVERYONE NEEDS TO KNOW

In the elementary grades, you have learned how to add, subtract, multiply, and divide whole numbers and fractions; you have learned what percentage is and how to find it. These calculations are used many times every day by persons in all kinds of business. One error in addition or in placing a decimal point by a clerk may mean the loss of hundreds of dollars to the business. Because no one can become absolutely accurate, business houses use machines for their long computations on which correct results may be found.

But there are many shorter calculations which must be made without machines and which must be just as accurate. A clerk in a store will be discharged if he makes very many errors in footing up a bill of goods he has sold. First of all he must learn to be accurate by checking or proving his work. If a clerk takes too long to foot up a customer's bill, that customer be-



comes impatient and others get tired of waiting. So he must learn to do the work quickly.

B. TWO GOALS

Accuracy and speed in the use of numbers are the two goals for which we all must strive. Accuracy with the checking of results comes first, then speed. In order to reach these goals, each of you must strive daily to improve your own record of the previous day. Just as athletes require daily practice to reach their goals in football, so you, as mental athletes, must have daily practice to reach your goals of accuracy and speed.

C. HOW TO MAKE MATHEMATICAL PICTURES

You will find it interesting to make pictures of your daily records and weekly averages to show your progress

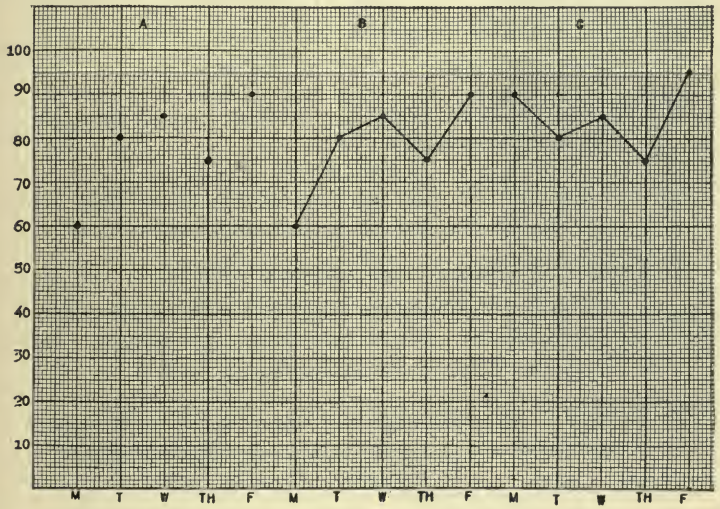
in accuracy. The picture is made on paper ruled into small squares. Suppose your record for a week is as follows:

Monday	60%
Tuesday	80%
Wednesday	85%
Thursday	75%
Friday	90%

There are several ways of making a picture of this record.

I. The Line Graph

1. *The First Method.* — On one of the horizontal lines, let different points stand for Monday, Tuesday, Wednesday,



Thursday, and Friday. On a vertical line, let each group of five spaces represent five per cent. Mark the different points as shown in the picture.

Directly above the point marked Monday and directly opposite the point marked 60% place a dot. In like manner place dots opposite the correct per cents for each of the other days (see Fig. A, page 3). Then draw a line connecting these points in sucession (see Fig. B). This line is a graph of the record for the week. The word *graph* is a part of a Greek word which means to *write* or *to draw*. Fig. C is a graph of another record.

(a) By looking at the graph on page 3 tell on which day the pupil made the highest grade. On which did he make the lowest?

(b) On how many days did his record show improvement over the preceding day? Which days were these?

(c) On how many days were his grades lower than his Monday's grade? Name the days.

(d) On which days were his grades better than his Monday's grade?

(e) His average for the week is found by adding the grades for the five days and dividing by five.

(f) Look at the graph and estimate whether or not the average for the week is above or below the Monday's grade. Then find the exact average and compare with your estimate.

(g) Graph your records for the week in various subjects.

(h) Find your average for each week and start a graph of your weekly averages for the semester in each subject, so that you can see the progress you are making.

II. The Bar Graph

1. *The Second Method.* — Instead of drawing a line for the graph, sometimes bars are used. The upper figure on this page is a bar graph of the same week's record which was used in the line graph.

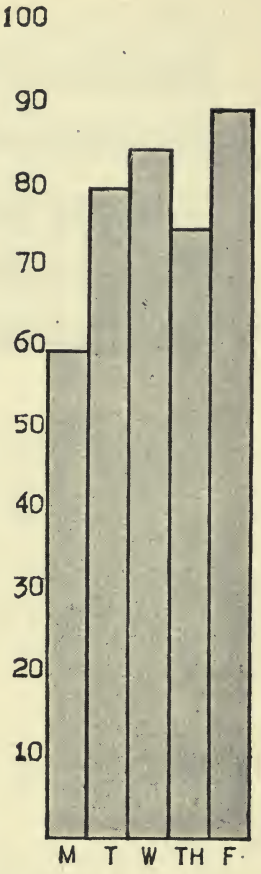
Sometimes horizontal bars are used. If the per cents are written on a horizontal line, then the days are written on the vertical line. (See lower figure on this page.)

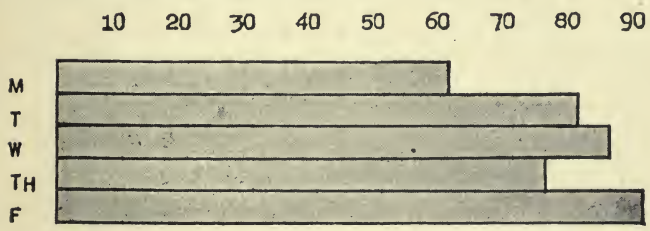
Instead of being placed together, the bars may be separated as in the upper figure on page 6.

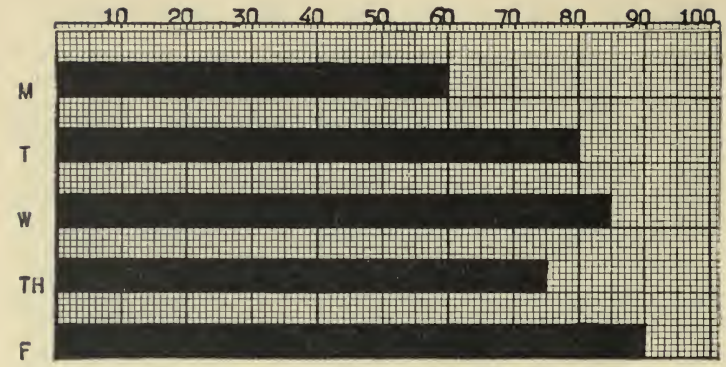
2. (a) If the lower graph, page 6, represents your spelling record for the week, on which day did you make the best grade? the poorest?

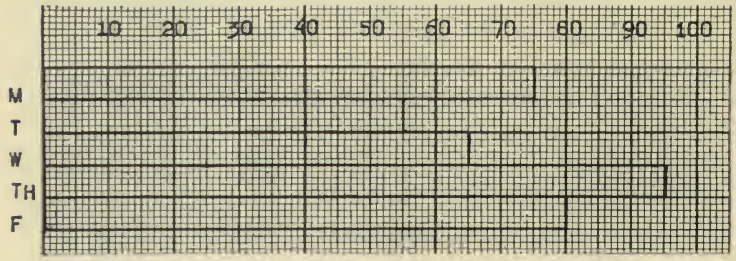
(b) If 70 % is a passing grade, is your average for the week above or below passing?

(c) Find the average for the week. How far above or below passing is it?









3. Ten boys in a class were racing with each other to see which one could make the best record in arithmetic.

Their records were as follows:

Days	A	B	C	D	E	F	G	H	I	J
Mon	65%	90%	70%	100%	85%	60%	95%	80%	75%	100%
Tues	80	80	75	70	80	70	95	70	95	80
Wed	75	70	80	65	95	80	80	95	70	90
Thurs	100	85	85	80	75	90	60	85	100	70
Fri.	90	75	90	85	90	100	85	80	90	95
Averages..										

(1) Make a line graph of each boy's record.

(2) Make a bar graph of each boy's record.

(3) Find each boy's average for the week and make a line graph of these averages.

D. RAPID CALCULATION IN ADDITION

I. Addition of Integers

A good exercise to increase speed in addition is to count by 2's, by 3's, and by all the other numbers up to 9, beginning with different numbers.

1. (a) Begin at 0, 1, and 2 and count by 3's to the first number greater than 100.
(b) Time yourself on each counting and see how much you can reduce the number of minutes after counting five times.

2. (a) Begin at 0, 1, 2, and 3 and count by 4's to the first number greater than 100.
(b) Time yourself as before.

3. Spend ten minutes every day for at least two weeks counting by 5's, 6's, 7's, 8's, and 9's, beginning first with zero and then with other numbers.

4. Suggestions for rapid and accurate addition:
(a) Write small neat figures.
(b) Space the figures well, neither too close together nor too far apart.
(c) Keep the columns straight.
(d) In adding think the results only. Do not repeat the separate numbers to yourself.
(e) Look for combinations of numbers whose sum is 10.
(f) Always check by adding the columns in the opposite direction.

5. Drill on the following until you can give all the results correctly in 45 seconds or less:

a	*b*	*c*	*d*	*e*	*f*
7	6	9	8	7	9
4	5	4	8	5	3
3	4	6	5	8	6

g	*h*	*i*	*j*	*k*	*l*
6	7	9	5	7	9
6	9	8	4	7	9
7	6	2	2	6	5

m	*n*	*o*	*p*	*q*	*r*
8	9	9	2	4	7
6	5	9	3	3	9
7	3	2	8	3	8

s	*t*	*u*	*v*	*w*	*x*
5	7	6	4	9	8
9	5	8	7	3	9
5	7	6	4	9	8

6. Add these numbers upward:

7	2	8	9
4	6	2	1
3	8	7	7
6	4	8	5
9	6	3	5
5	3	1	2
1	0	7	3
3	8	2	9	2

What combinations of 5's or 10's do you find in each column?

Check by adding downward and writing the sum of each column separately and adding these partial sums.

32	(units)
36	(tens)
29	(hundreds)
35	(thousands)
38292	(sum checked)

Add and check:

7	8	9	10	11
6 3 8	3 4 6	5 9 6	8 6 7	9 8 2
2 4 9	8 9 2	7 3 4	5 4 9	1 2 8
3 8 7	7 6 3	6 9 3	3 4 6	2 7 6
7 6 3	4 3 5	4 7 8	2 4 1	3 5 0
3 4 7	8 9 9	5 1 4	7 6 4	8 3 2
4 5 2	2 1 5	3 7 6	2 8 9	7 6 1
2 1 2	3 4 4	8 3 2	1 3 2	7 4 3

12	13	14	15	16
3 2 4 6	7 4 6 8	2 3 7 6	5 8 9 6	8 9 6 0
4 9 8 7	9 3 7 5	3 9 4 2	7 4 6 7	8 7 3 5
5 4 5 9	5 6 8 1	4 3 5 4	3 6 4 3	9 6 5 4
2 8 9 2	7 9 4 7	9 8 7 6	8 5 9 4	4 9 2 8
4 8 7 6	4 3 8 9	4 9 6 0	3 2 4 1	7 6 8 7
3 7 2 3	7 6 9 4	6 7 5 6	2 3 1 4	2 6 4 5
5 5 3 1	5 4 2 1	1 2 4 1	8 9 9 6	1 3 5 8

17. Some accountants use another method of checking called "*casting out nines.*"

The following problem shows how it is used:

5 3 4	3
7 2 1	1
9 8 1	0
7 8 7	4
4 3 0	7
3 4 5 3 | 6 = 6	

In each number, add the digits, dropping out the 9's as you do it, and write the remainder opposite each number.

In the first number, drop the 5 and 4 and write the remainder 3. In the fourth number, think $7 + 8 = 15$; drop 9, leaving 6; $6 + 7 = 13$; drop 9, leaving 4.

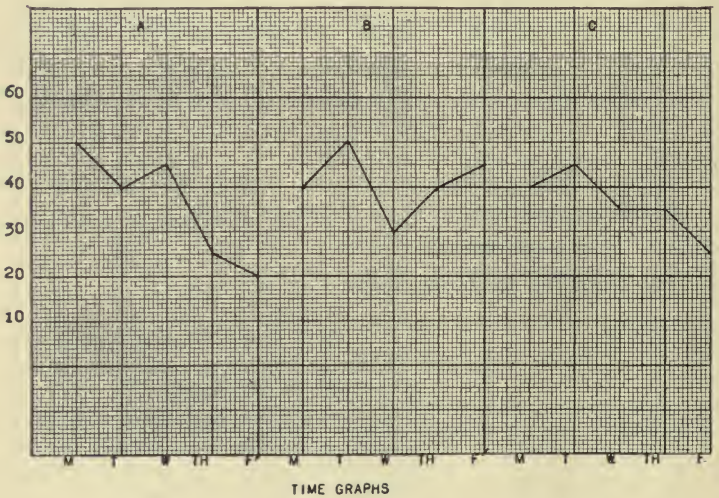
Add these remainders, dropping out 9's as you do it, thus: $7 + 4 = 11$; drop 9 leaving 2. $2 + 1 + 3 = 6$, the final remainder. From the sum drop the 4 and 5, which leaves $3 + 3 = 6$ as the remainder. The remainder from the sum must equal the final remainder from the numbers added.

Casting out nines is not an absolute proof that the addition is correct, but it is a fairly good proof.

18. (a) For practice in addition, pupils may write columns of three- and four-place figures and add.

(b) A better drill may be had by using the Courtis Standard Tests. These are sets of cards with well-graded exercises in addition, subtraction, multiplication, and division, with standards of time set for each. With these tests are cards on which pupils keep graphs of their records in both accuracy and speed.

19. A time or speed graph may be made similar to the ones which measured the pupils' accuracy.



TIME GRAPHS

The three graphs show the time spent by a pupil in preparing his arithmetic lesson for three weeks.

(a) State the time for each day of each week.
(b) On which day of each week was he the slowest?
(c) On which day was he the quickest?

(d) If the lessons were of equal length and difficulty, on which day in each week did he show the most improvement over the preceding day?

(e) Find his average time for each week and draw a graph of the three averages.

(f) In the graphs of accuracy, does a line sloping upward show improvement or the reverse?

(g) In a time graph, which way does the line slope to show improvement?

20. HORIZONTAL ADDITION

Clerks' Daily Sales for Week Ending November 2, 1918

Name	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total
Alcott, L. L.....	145 62	98 50	169 78	231 70	84 76	175 44	... 80
Brown, C. E....	156 75	141 97	148 92	150 98	154 76	158 69	
Davis, M. T....	198 53	200 94	175 49	186 73	150 96	240 87	
Harmon, W. F..	151 07	150 86	102 68	79 43	88 75	198 73	
Morto, F. E....	96 87	95 69	106 87	85 99	87 46	102 46	
Stone, C. T.....	205 48	306 50	426 30	241 08	198 66	514 67	
Wills, W. W....	415 97	427 34	396 42	250 18	387 98	607 94	
Totals.....							

(a) The foregoing list shows in tabular form the sales made by each clerk on each day of the week.

(b) At the bottom the total sales for each day may be found by adding the columns.

(c) But the firm wishes to keep a record of the total weekly sales of each clerk. These totals may be found by adding each horizontal row. The results should be placed in the right-hand column. In horizontal addition, place a dot or check mark over each figure as it is added. Why is this advisable?

21. Tabular Forms for Addition

(a) *Classified Expenses of a Pupil for a Week*

	Lunch	Books, Supplies	Recreation	Gifts	Car Fare	Savings	Total
Sun	...	....	...	.10	.10	....	....
Mon	.15	1.00	...	1.25	.10	.10	....
Tues	.19	.05	...	.10	.10	.05	....
Wed	.12	.54	.10	....	.10	5.00	....
Thurs	.20	.15	...	....	.10	.25	....
Fri	.25	.02	.25	.05	.10	.15	....
Sat	...	....	.50	....	.10	....	....
Totals							

(b) *Pupil's Weekly Expenses*

	Lunch	Books, Supplies	Recreation	Gifts	Car Fare	Savings	Total
Sun	...	....	...	.05	....	....	....
Mon	.15	.07	.22	....	....	....	....
Tues	.15	.15	.05	....	....	....	....
Wed	.15	1.00	...	.05	.05	....	....
Thurs	...	.05	...	....	....	....	....
Fri	...	.05	.15	....	.05	....	....
Sat	...	....	.25	1.00	.05	5.00	....
Totals							

(c) *Expenses of an Electric for a Year*

	Current	Flushing Battery	Washing Car	Tires, Tubes	License, General Repairs	Total
Jan.....	1.25	....	1.25	3.80	10.50	.....
Feb.....	2.75	.50	....	.....	.....	.....
Mar.....	3.75	.50	....	.....	1.10	.....
Apr.....	3.75	.50	....	41.19	.45	.....
May.....	3.75	.50	1.25	.....	1.50	.....
June.....	3.75	....	....	.....	.....	.....
July.....	2.50	1.00	1.25	.....	2.50	.....
Aug.....	1.25	.50	....	.....	.50	.....
Sept.....	2.50	.50	....	54.00	3.00	.....
Oct.....	5.00	.50	....	.....	.75	.....
Nov.....	3.75	.50	1.25	41.00	1.65	.....
Dec.....	5.00	.50	1.25	.45	1.45	.....
Totals..						

This car ran 1976 miles during the year. Find the average cost a mile.

II. Addition of Fractions and Mixed Numbers

1. (a) Can you find one sum for 2 feet plus 10 inches?

(b) What change do you have to make in one of these measures before you can add them?

(c) We see that before two numbers with names can be added, the names must be alike.

$\frac{2}{3}$ is 2 thirds.

$\frac{3}{4}$ is 3 fourths.

(d) Which words give names to the numbers 2 and 3?

(e) In the fraction form which term gives the name of the fraction?

(f) The word *denominator* comes from a Latin word which means *name*. You are familiar with the middle part of it in the word *nominate*, which means to *name* for an office.

(g) Fractions with different denominators are like other numbers with names; that is, we have

to change them to like names before we can add them.

2. (a) Add $\frac{2}{3}$ and $\frac{3}{4}$ or 2 thirds and 3 fourths.

(b) There are many common names for thirds and fourths, as twelfths, twenty-fourths, thirty-sixths, etc. But it is most convenient to change them to the common name that is the lowest, so we choose twelfths.

(c) How can you change 2 thirds to twelfths? ($\frac{2}{3} = \frac{?}{12}$)
How can you change 3 fourths to twelfths? ($\frac{3}{4} = \frac{?}{12}$)

(d) In adding named numbers, as 2 feet or 24 inches to 10 inches, which parts do you add? What do you do with the common name?

(e) In adding $\frac{2}{3}$ or $\frac{8}{12}$ to $\frac{3}{4}$ or $\frac{9}{12}$, which numbers do you add? What name do you give the sum?

$$\begin{array}{r} \frac{2}{3} = \frac{8}{12} \text{ or } 8 \text{ twelfths} \\ \frac{3}{4} = \frac{9}{12} \text{ or } 9 \text{ twelfths} \\ \hline \frac{17}{12} \text{ or } 17 \text{ twelfths} \end{array}$$

(f) Which parts of the fractions do you add?

(g) The word *numerator* comes from another Latin word which means *number*. The numerators or numbers are the parts of the fractions to be added.

(h) Why do you never add the denominators of fractions?

3. (a) Is $\frac{17}{12}$ of a bushel greater or less than 1 bushel?

(b) What name do you give to a fraction whose value is greater than 1?

(c) What name do you give to a fraction whose value is less than 1?

(d) How many twelfths are there in 1?

(e) How many more are there in $\frac{17}{12}$ than in 1?

(f) Read $\frac{17}{12}$ as partly a whole number and partly a fraction.

(g) Why is *mixed number* a suitable name for it?

(h) Which kind of fractions can be changed to mixed numbers?

(i) Explain how improper fractions may be changed to whole or mixed numbers.

III. Test Problems

1. Add:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{1}{3}$
$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{16}$	$\frac{7}{8}$	$\frac{3}{8}$	$\frac{5}{6}$
$\frac{1}{4}$	$\frac{2}{3}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{2}{3}$

2. Add $\frac{1}{2}$ and $\frac{1}{3}$.

If the numerators of two fractions are 1 and if the denominators cannot be divided by any common number, the fractions may be added quickly as follows:

$$\frac{1}{2}+\frac{1}{3}=\frac{3+2}{3\times 2}=\frac{5}{6}.$$

What did you do to 3 and 2 to get 5, the numerator of the sum?

What did you do to 3 and 2 to get 6, the denominator of the sum?

3.
$$\frac{1}{3}+\frac{1}{5}=\frac{5+3}{5\times 3}=\frac{8}{15}.$$

Add these fractions in the usual way to see if this method is correct.

4. Read the sums of these fractions:

(a) $\frac{1}{3}+\frac{1}{4}$	(b) $\frac{1}{2}+\frac{1}{5}$	(c) $\frac{1}{4}+\frac{1}{7}$	(d) $\frac{1}{3}+\frac{1}{8}$
(e) $\frac{1}{5}+\frac{1}{6}$	(f) $\frac{1}{5}+\frac{1}{7}$	(g) $\frac{1}{5}+\frac{1}{8}$	(h) $\frac{1}{5}+\frac{1}{9}$
(i) $\frac{1}{3}+\frac{1}{7}$	(j) $\frac{1}{6}+\frac{1}{7}$	(k) $\frac{1}{7}+\frac{1}{8}$	(l) $\frac{1}{8}+\frac{1}{9}$
(m) $\frac{1}{3}+\frac{1}{10}$	(n) $\frac{1}{4}+\frac{1}{9}$	(o) $\frac{1}{2}+\frac{1}{7}$	(p) $\frac{1}{9}+\frac{1}{10}$

5. (a) In the same way, add $\frac{1}{4}$ and $\frac{1}{2}$.

$$\frac{1}{4}+\frac{1}{2}=\frac{2+4}{2\times 4}=\frac{6}{8}.$$

(b) To find whether this sum is correct, add these fractions in the usual way:

$$\begin{array}{r} \frac{1}{4} = \frac{1}{4} \\ \frac{1}{2} = \frac{2}{4} \\ \hline \frac{3}{4} \end{array}$$

(c) What is the difference between $\frac{6}{8}$ and $\frac{3}{4}$?

6. Explain what is meant by a fraction in lowest terms?

7. How can you change a fraction to its lowest terms?

$$\frac{6}{8} = \frac{2 \times 3}{2 \times 2 \times 2} = \frac{3}{4}$$

$$\frac{12}{18} = \frac{2 \times 2 \times 3}{2 \times 3 \times 3} = \frac{2}{3}$$

Six may be written as the product of 2 and 3.

Two and 3 are called the factors of 6, because they are the two numbers which when multiplied together "make" 6. *Factor* is a Latin word which means a *maker*.

8. Eight may be written as 4×2. These are factors of 8. But 4 may be divided again into 2×2. A factor, such as 2, 3, 5, 7, 11, which cannot be divided again except by itself or 1, is a *prime factor*.

9. Express $\frac{8}{12}$ in its prime factors.

$$\begin{aligned} \frac{8}{12} &= \frac{2 \times 2 \times 2}{2 \times 2 \times 3} \\ &= \tfrac{2}{2} \times \tfrac{2}{2} \times \tfrac{2}{3} \\ &= 1 \times 1 \times \tfrac{2}{3} \\ &= \tfrac{2}{3} \end{aligned}$$

10. Show why you can cancel two equal prime factors from the numerator and denominator of a fraction to change it to lowest terms.

11. Always put two tests to the result of your problem, if it contains a fraction:

(a) Has every improper fraction been changed to a whole number or to a mixed number?

(b) Is every proper fraction in its lowest terms?

Add the following:

12	13	14	15	16
$5\frac{1}{2}$	$8\frac{2}{3}$	$5\frac{2}{3}$	$5\frac{4}{9}$	$17\frac{1}{4}$
$6\frac{1}{3}$	$9\frac{1}{6}$	$4\frac{5}{6}$	$8\frac{2}{3}$	$12\frac{2}{3}$

17	18	19	20	21
$4\frac{1}{3}$	$2\frac{1}{2}$	$7\frac{2}{3}$	$3\frac{2}{5}$	$3\frac{1}{2}$
$6\frac{1}{2}$	$3\frac{2}{3}$	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{1}{6}$

22	23	24	25	26
$7\frac{1}{8}$	$1\frac{7}{8}$	$7\frac{1}{8}$	$6\frac{5}{12}$	$5\frac{2}{3}$
$13\frac{1}{2}$	$2\frac{3}{16}$	$3\frac{1}{4}$	$7\frac{7}{8}$	$4\frac{1}{2}$
$14\frac{3}{4}$	$1\frac{1}{2}$	$7\frac{5}{6}$	$2\frac{1}{2}$	$2\frac{1}{4}$

27	28	29	30	31
$3\frac{1}{2}$	$5\frac{3}{4}$	$8\frac{7}{8}$	$4\frac{1}{6}$	$24\frac{7}{8}$
$2\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{2}{3}$	$7\frac{5}{12}$	$10\frac{2}{3}$
$4\frac{1}{2}$	$7\frac{3}{4}$	$5\frac{1}{2}$	$13\frac{1}{2}$	$12\frac{5}{6}$
$5\frac{3}{4}$	$3\frac{1}{4}$	$2\frac{5}{6}$	$27\frac{2}{3}$	$5\frac{7}{12}$

IV. Addition of Decimal Fractions

1. (a) If we multiply two 10's together, we get 100, the second power of 10.
   (b) If we multiply three 10's together, we get 1000, the third power of 10.
   (c) Every fraction whose denominator is 10, 100, 1000, or some other power of 10 is a decimal fraction.
   (d) *Decimal* comes from a Latin word *decem* that means *ten.*
   (e) Usually decimal fractions are written without denominators.

Instead, a dot or decimal point shows what the denominator is.

$\frac{1}{10} = .1$ = 1 tenth.	$\frac{7}{10} = .7$ = 7 tenths.
$\frac{1}{100} = .01$ = 1 hundredth.	$\frac{75}{100} = .75$ = 75 hundredths.
$\frac{1}{1000} = .001$ = 1 thousandth.	$\frac{125}{1000} = .125$ = 125 thousandths.

(f) How does the number of decimal places compare with the number of zeros in the denominator of the fraction?

(g) Read and add the following:

(1)	(2)	(3)	(4)	(5)
$1.05	$2.15	$3.87	$4.75	$5.64
.75	.85	.92	3.42	.79
2.86	3.75	5.40	.78	3.98
1.76	.34	.59	1.96	.47
.38	1.50	1.12	2.35	1.38
3.50	5.62	4.32	1.43	.13

(6)	(7)	(8)	(9)	(10)
.368	546.8	87.6	1.8	.875
.379	1.64	4.32	7.64	2.40
.326	12.38	13.005	3.468	5.687
.310	.07	800.616	.95	4.532
.287	85.643	1.05	30.05	1.1
.298	1.406	8.36	8.74	.086

(h) Check the results.

E. RAPID CALCULATION IN SUBTRACTION

I. Subtraction of Integers

Begin at 100, 99, 98, 97, 96, . . . 91 and count backward by 3's, 4's, 5's, . . . 9's.

Spend ten minutes each day for at least two weeks counting backward.

Keep a record of the number of counters you can use in the ten minutes.*

Drill on the following subtractions until you can read the results in one minute and a half, or less.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	7	9	8	12	11	10	11	18
	1	4	3	7	3	7	6	9
2.	12	5	6	13	15	17	14	20
	4	3	3	7	8	9	11	10
3.	24	35	46	59	62	78	83	76
	7	18	25	38	29	46	55	58
4.	77	34	98	44	57	81	49	82
	29	18	76	39	46	76	34	73
5.	24	39	54	68	23	19	56	87
	8	26	38	47	14	8	49	51

* Pupils are to count backward first by 3's, then by 4's, and so on. These numbers are the counters. The first day a pupil may count only by 3's, 4's, and 5's. Gradually he may increase the number of counters he uses in 10 minutes.

II. Practice Exercises

Solve these examples in subtraction. Time yourself each day for a week. Make a graph of your record. Does it slope in the right direction?

	a	*b*	*c*	*d*	*e*
1.	236	489	576	975	763
	189	324	389	598	549
	324	725	863	328	643
	249	532	54	159	507
3.	5864	6954	7896	7546	4562
	2789	4375	5962	3387	3498
4.	9643	5872	9987	8393	5436
	8765	4368	7248	5607	208

5. (a) From 19,324 | Minuend (meaning *to be lessened*)
Subtract 8,697 | Subtrahend (meaning *to be taken away*)
10,627 | Difference

(b) For convenience, we give special names to the three numbers in a subtraction problem.

(c) Why is *minuend* a good name for the number from which another one is to be taken?

(d) Why is *subtrahend* a good name for the number which is taken from the minuend?

(e) What is the name of the result in subtraction?

(f) Add the difference to the subtrahend in problem 5 (a). What is the result?

(g) Subtract the difference from the minuend. What is the result?

(h) In what two ways may you check your work in subtraction? Which method is the easier?

III. Time Tests

Subtract and check the following problems. Time yourself. If it takes you longer than two minutes, make up similar problems for practice until you can work them

within the given time, or drill on Courtis Standard Tests in subtraction until you develop the desired speed and accuracy.

Do not copy these problems. Place a sheet of paper beneath the first group and write the results. Fold this set of results under and write those of the next row. To save time make five folds in your paper before you begin to write.

	a	*b*	*c*	*d*	*e*
1.	1.00	1.00	.50	.75	2.00
	.46	.23	.14	.59	1.46
2.	324	189	716	498	597
	176	27	589	347	213
3.	694	413	578	413	600
	327	196	397	247	243
4.	38.96	74.56	13.074	42.68	50.00
	14.075	32.48	1.39	10.097	38.15
5.	400.6	4.0068	15.96	10.00	2.008
	30.94	.309	.08	5.96	.9864

IV. Making Change

How does a clerk in a store count change?
Illustration:

\$.86 out of \$1.00.
86 and 4 are 90 and 10 is \$1.00.
Therefore the change is 14 cents.

In the following transactions, count the change as in business.

	Money Presented	Amount of Purchase	Change
1	$ 1.00	$ .49	
2	2.00	1.87	
3	5.00	3.21	
4	.75	.58	
5	10.00	3.10	
6	4.00	3.37	
7	6.00	5.19	
8	5.00	4.21	
9	20.00	18.29	
10	15.50	15.13	
11	7.00	6.17	
12	2.00	1.84	
13	5.00	.42	
14	10.00	8.34	
15	3.00	2.10	
16	1.00	.36	
17	2.50	2.18	
18	20.00	13.50	
19	1.50	1.11	
20	5.00	3.42	

V. Subtraction of Fractions

What must be added to each of the following fractions to make 1?

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{2}{5}$	$\frac{3}{4}$	$\frac{1}{6}$	$\frac{2}{3}$	$\frac{3}{8}$	$\frac{1}{4}$
2.	$\frac{5}{8}$	$\frac{1}{5}$	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{1}{12}$	$\frac{3}{16}$	$\frac{3}{5}$	$\frac{7}{12}$
3.	.1	.05	.001	.36	$.37\frac{1}{2}$	.88	.08	$.66\frac{2}{3}$
4.	.6	.75	$.12\frac{1}{2}$	.03	.004	$.16\frac{2}{3}$	.099	$.06\frac{1}{4}$

Subtract the following:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
5.	$\frac{3}{4}-\frac{1}{4}$	$\frac{5}{8}-\frac{1}{4}$	$\frac{1}{2}-\frac{1}{3}$	$\frac{1}{3}-\frac{1}{4}$	$\frac{2}{3}-\frac{1}{6}$	$\frac{7}{16}-\frac{1}{4}$	$\frac{1}{4}-\frac{1}{5}$	$\frac{1}{5}-\frac{1}{6}$
6.	$\frac{3}{4}-\frac{3}{5}$	$\frac{7}{8}-\frac{2}{3}$	$\frac{9}{10}-\frac{1}{5}$	$\frac{17}{24}-\frac{1}{3}$	$\frac{7}{9}-\frac{1}{3}$	$\frac{11}{12}-\frac{3}{4}$	$\frac{7}{18}-\frac{1}{6}$	$\frac{7}{3}-\frac{2}{3}$

7.	$3\frac{1}{2}$	$9\frac{1}{5}$	$15\frac{2}{3}$	$25\frac{7}{8}$	$7\frac{4}{5}$	$96\frac{3}{4}$	$85\frac{1}{2}$
	$1\frac{1}{3}$	$7\frac{1}{10}$	$7\frac{1}{6}$	$10\frac{3}{4}$	$3\frac{3}{10}$	$17\frac{1}{2}$	$34\frac{7}{8}$
8.	$106\frac{2}{3}$	$327\frac{1}{2}$	$789\frac{1}{4}$	$986\frac{1}{12}$	$35\frac{9}{16}$	$536\frac{1}{2}$	$435\frac{5}{8}$
	$97\frac{2}{5}$	$202\frac{5}{8}$	$6\frac{1}{2}$	$872\frac{1}{3}$	$11\frac{7}{8}$	$24\frac{1}{3}$	$136\frac{1}{4}$

9.	11.867	40.086	376.2	45.06	98.009	56.87	49.516
	7.925	1.792	87.94	27.892	17.234	14.961	13.24

VI. Combination of Addition and Subtraction

Ten, 15, 20, 25, etc., are multiples of 5; for $5 \times 2 = 10$, $5 \times 3 = 15$, etc.

What number must be added to each of the given combinations to make the sum the next higher multiple of 5?

Illustrative problem:

9	
7	$9 + 7 = 16$.
?	The next multiple of 5 above 16 is 20.
4	Four must be added to 9 and 7 to make 20.
20	

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	8	4	7	1	3	8	7	9
	3	1	6	2	3	8	4	2
	?	?	?	?	?	?	?	?
2.	6	6	7	4	5	7	9	8
	8	9	7	3	3	1	5	4
	?	?	?	?	?	?	?	?
3.	4	5	3	5	7	1	8	1
	2	1	7	5	8	6	2	1
	?	?	?	?	?	?	?	?
4.	5	2	4	2	4	9	7	9
	2	7	5	6	4	4	5	1
	?	?	?	?	?	?	?	?

5.	8	5	2	4	2	4	9	9
	3	6	2	8	1	6	3	9
	?	?	?	?	?	?	?	?
6.	19	28	16	14	27	18	25	17
	7	13	22	29	31	24	18	18
	?	?	?	?	?	?	?	?
7.	8	25	18	19	27	21	33	15
	23	13	8	29	11	11	13	25
	?	?	?	?	?	?	?	?
8.	23	19	17	27	7	15	14	19
	17	27	16	27	14	11	21	15
	?	?	?	?	?	?	?	?

F. RAPID CALCULATION IN MULTIPLICATION

I. Multiplication of Integers

1													
2	**4**												
3	6	**9**											
4	8	12	**16**										
5	10	15	20	**25**									
6	12	18	24	30	**36**								
7	14	21	28	35	42	**49**							
8	16	24	32	40	48	56	**64**						
9	18	27	36	45	54	63	72	**81**					
10	20	30	40	50	60	70	80	90	**100**				
11	22	33	44	55	66	77	88	99	110	**121**			
12	24	36	48	60	72	84	96	108	120	132	**144**		
13	26	39	52	65	78	91	104	117	130	143	156	**169**	
14	28	42	56	70	84	98	112	126	140	154	168	182	**196**
15	30	45	60	75	90	105	120	135	150	165	180	195	210	**225**
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**

1. Drill on the accompanying table until all the products can be given promptly and correctly.

2. (a) What is the area of a square 2 inches on a side?

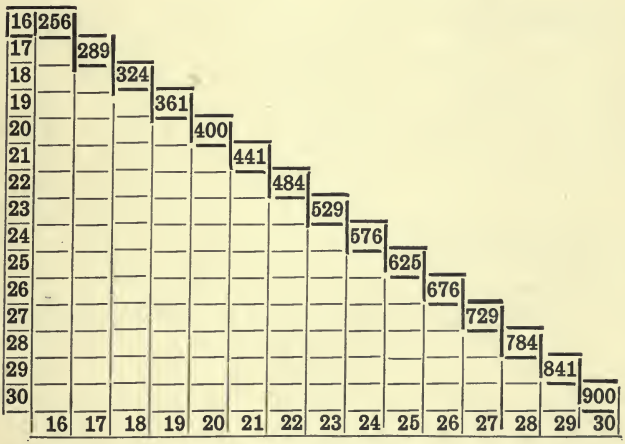
(b) Since 2×2 gives the area of a square, the product 4 is called the square of 2. It is sometimes written thus, 2^2, and is read "the square of 2" or "2 squared."

(c) $3 \times 3 = 3^2 = 9$.

3. (a) Look at the numbers in the foregoing table that are in the little squares that form the steps.

(b) What kind of number is each one?

4. It is convenient to know some products other than those in the foregoing table. One should know just as readily the squares of the other numbers up to 30, as given in the second table. Knowledge of these squares may be used as a check on other multiplication. For example, if you multiply 23×25, you should know that the product should be very near 24^2 or 576. If by mistake your product is 675, you can see immediately that it is wrong.



5. Near what numbers of this table are the following products?

(a) 16×18
(b) 27×29
(c) 21×23
(d) 19×21
(e) 24×26
(f) 25×27
(g) 17×19
(h) 22×24
(i) 23×25
(j) 26×28

6. (a) The exact products of these numbers may be found from this table by subtracting 1 from the square of the number between them.

$$\begin{aligned} 16 \times 18 &= 17^2 - 1 \\ &= 289 - 1 \\ &= 288 \end{aligned}$$

17 is the number between 16 and 18.
Its square is 289.
The product of 16×18 is $289 - 1$ or 288.

(b) Multiply 16 by 18 to test this result.

(c) Give the exact products of the numbers in the foregoing list.

7. Multiply 637 by 134.

$$\begin{array}{r} 637 \\ 134 \\ \hline 2548 \\ 1911 \\ 637 \\ \hline 85358 \end{array}$$

8. Proofs of Multiplication

(a) First Proof

Exchange the numbers, that is, multiply 134 by 637.

$$\begin{array}{r} 134 \\ 637 \\ \hline 938 \\ 402 \\ 804 \\ \hline 85358 \end{array}$$

(b) Second Proof

Casting out nines

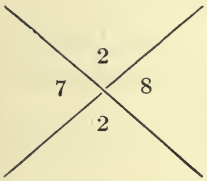
637	7		
134	8		
2548	56	2	
1911			
637			
85358			2

Explanation

After casting out nines from both multiplicand and multiplier 7 and 8 are left. Their product is 56. Cast nines out of 56 and 2 is left. Cast nines out of the result, 85,358, and 2 is left.

Since 2 = 2, the multiplication is probably correct.

The remainders after casting out the nines may be put in the form of a cross, a large multiplication sign, thus:



Put 7 and 8, the remainders from the two factors, on either side of the cross.

Cast the nines out of 7×8 or 56 and put the remainder 2 in the upper opening. In the lower opening put the 2 found by casting nines out of the result. If the two numbers in the upper and lower openings are alike the multiplication is probably correct.

(c) Third Proof

The product divided by either factor gives the other factor as a result.

$$\begin{array}{r|l} & 637 \\ \hline 134 & 85358 \\ & 804 \\ \hline & 495 \\ & 402 \\ \hline & 938 \\ & 938 \\ \hline \end{array}$$

Multiply the following, and prove the results:

	a	*b*	*c*	*d*	*e*	*f*
9.	81	105	76	89	209	6780
	27	39	47	53	310	1900
10.	328	5280	478	5770	1357	97530
	247	34	1090	208	987	1300
11.	729	9037	1038	2008	4693	40800
	189	4690	190	1060	867	970

II. Multiplication of Fractions

1. (a) Numbers with decimal places are multiplied as whole numbers, but the decimal point in the product must be placed carefully.
   (b) How do you find the number of decimal places to point off in the product?
   (c) Suppose, by mistake, your decimal point is one place too far to the right. Is your product too large or too small? How many times too large or too small is it?
   (d) Suppose it is one place too far to the left, how far wrong is your result?
   (e) What effect will it have if it is two places too far to the right? to the left?
   (f) A decimal point is a little thing, but a slight change in its position makes a big change in the value of the number. Therefore it must be carefully and correctly placed.

Multiply and check the following:

	a	*b*	*c*	*d*
2.	$1.45	3.74	1.89	98.2
	18	27	4.2	3.07

3.	.075	$3.18	598	.763
	4.2	.0155	.011	.046
4.	8.65	32.5	9.73	$1.96
	.65	5.68	12.4	19
5.	57.4	.143	$8.76	206
	10.8	.009	16	.35

Read the following products:

	a	*b*	*c*	*d*
6.	$\frac{1}{2}$ of $.75	$\frac{1}{3}$ of $.75	$\frac{1}{3}$ of $1.50	$\frac{1}{4}$ of $5.00
7.	$\frac{1}{2}$ of $\frac{3}{4}$	$\frac{1}{3}$ of $\frac{3}{4}$	$\frac{1}{3}$ of $1\frac{1}{2}$	$\frac{1}{4}$ of 5
8.	$\frac{1}{6}$ of 8	$\frac{1}{2}$ of 49	$\frac{1}{3}$ of $9.60	$\frac{1}{2}$ of $2.75
9.	$\frac{1}{4}$ of $1\frac{1}{8}$	$\frac{1}{8}$ of $1\frac{1}{2}$	$\frac{1}{4}$ of 7	$\frac{1}{3}$ of $\frac{3}{8}$
10.	$\frac{1}{4}$ of $900	$\frac{1}{6}$ of 20	$\frac{1}{3}$ of $\frac{3}{8}$	$\frac{1}{4}$ of 9

III. Short Cuts in Multiplication

There are many short cuts in multiplication. A few of the most convenient ones are given.

1. To multiply by 10, 100, 1000, etc.

(a) Multiply 6285 by 10, 100, and 1000, and explain how you can find the products by annexing zeros.

(b) Multiply 62.85 by 10, 100, and 1000, and explain how you can find the products by moving the decimal point.

(c) Multiply 62.85 by 300.
Since $300 = 100 \times 3$, how can you find the product by a short cut?

(d) Make up and solve ten problems of each of these kinds.

2. To multiply by 25

(a)
$$25 = \frac{100}{4}$$
$$102.4 \times 25 = 102.4 \times \frac{100}{4}$$
$$= \frac{10240}{4}$$
$$= 2560$$

(b) Make up ten problems to be multiplied by 25. Let the boys solve those made up by the girls and vice versa.

3. To multiply by 11

(a) $\widehat{245} \times 11 = 2695$

Write the right-hand digit, 5.

Write in order to the left the sum of the first and second figures $(4 + 5)$; then the sum of the second and third figures $(4 + 2)$. Write 2, the left-hand figure.

(b) $\widehat{958} \times 11 = 10{,}538$

This product may be written in the same way, except that the sum of the first and second figures is 13, therefore write the 3 in front of the 8 and carry the 1 to the next sum of 5 and 9.

$1 + 5 + 9 = 15$. Write the 5 and carry the 1 to add to the left-hand figure, $9 + 1 = 10$.

(c) $\widehat{2487} \times 11 = 27{,}357$

Explain how this product is found.

Multiply 2487×11 in the long way to see why this method of adding the digits in succession is correct.

(d) Make up ten numbers to be multiplied by 11. Exchange with your classmates and solve the problems.

4. To multiply any number ending in $\frac{1}{2}$, .5, or 5, by itself

(a) $4\frac{1}{2} \times 4\frac{1}{2} = 20\frac{1}{4}$

Multiply the integer 4 by the next higher number 5, getting 20, and add $\frac{1}{4}$, which is $\frac{1}{2} \times \frac{1}{2}$.

(b) $4.5 \times 4.5 = 20.25$

If the $\frac{1}{2}$ is expressed as the decimal .5, multiply the whole numbers in the same way as before

and add .25, which is $.5 \times .5$. Compare $20\frac{1}{4}$ with 20.25.

(c) $45 \times 45 = 2025$

Evidently 45×45 gives the same product without any decimal point.

(d) Write the following products:

(1) $3\frac{1}{2} \times 3\frac{1}{2} =$
(2) $5.5 \times 5.5 =$
(3) $75 \times 75 =$
(4) $8\frac{1}{2} \times 8\frac{1}{2} =$
(5) $9.5 \times 9.5 =$
(6) $65 \times 65 =$
(7) $13.5 \times 13.5 =$
(8) $9\frac{1}{2} \times 9\frac{1}{2} =$
(9) $(7\frac{1}{2})^2 =$
(10) $(85)^2 =$
(11) $(12\frac{1}{2})^2 =$
(12) $(5\frac{1}{2})^2 =$
(13) $(11\frac{1}{2})^2 =$
(14) $(14\frac{1}{2})^2 =$
(15) $(6.5)^2 =$
(16) $(10.5)^2 =$

5. Supplementary Multiplication

(a) Fifteen is the supplement of 115, because it shows how much greater 115 is than 100.

Any number that shows how much greater another number is than 100 is its supplement.

Three is the supplement of 103.

(b) Multiply 115 by 103.

115	15 (sup.)
103	3 (sup.)
11845	45

To 115 add 3, the supplement of 103, getting 118. To this annex 45, the product of the two supplements.

(c) Show that either supplement may be added to the other number to make 118.

(d) Multiply 104 by 102.

104	4 (sup.)
102	2 (sup.)
10,608	8

If the product of the two supplements has only one digit, as 8, write a zero between it and the other part, as 10,608.

(e) Using supplements, multiply the following:

105	118	107	112	113
102	103	108	106	105

(f) Multiply 142 by 105.

147	42 (sup.)
105	5 (sup.)
147	210
210	
14,910	

If the product of the supplements contains three figures, it may be added as in the illustration.

(g) Multiply the following using supplementary multiplication:

125	119	116	106	114
104	111	107	105	109

6. Complementary Multiplication

(a) Four is the complement of 96 because it shows how much less 96 is than 100. In other words, 96 needs 4 added to it to make it a complete 100.

Any number which shows how much must be added to another number to make 100 is its complement. Eight is the complement of 92.

(b) Multiply 96×92.

96	4 (comp.)
92	8 (comp.)
8832	32

From 96 subtract 8, the complement of 92, getting 88. To 88 annex 32, the product of the two complements.

(c) May either complement be subtracted from the other number to make 88?

(d) Multiply 99×98.

$$\begin{array}{rr} 99 & 1 \\ 98 & 2 \\ \hline 9702 & \end{array}$$

(e) Multiply 91×88.

$$\begin{array}{rr} 91 & 9 \\ 88 & 12 \\ \hline 79 & \\ 108 & \\ \hline 8008 & \end{array}$$

Two and only two digits must be annexed. If necessary fill in a zero or add the third digit to the first figure of the difference.

(f) Using complementary multiplication, multiply the following:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
97	95	99	94	98	89	96	93
92	91	88	89	93	88	87	92
(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
97	99	98	94	96	93	94	89
94	95	97	93	86	91	95	91

7. Which of the short cuts should be used in each of these problems?

	(1)	(2)	(3)
(a)	286×400	75.8×25	98×97
(b)	85×85	112×108	$(3\frac{1}{2})^2$
(c)	2794×11	7.5×7.5	108×105
(d)	$(13\frac{1}{2})^2$	24×26	$\$4.98 \times 300$
(e)	29×27	65×65	88×93

8. (a) Let half the class solve these problems by the short cuts and the other half by the regular long methods.

(b) Each pupil should keep a record of the exact time he takes to work the set.

(c) Find the average time for the group using the short cuts; for the group using the long methods. How much time is saved by the short cuts?

IV. Multiplication of Mixed Numbers

1. What is a mixed number?

2. Mixed numbers with small integral parts may be multiplied in two ways:

(a) By changing a mixed number to an improper fraction and multiplying, as:

$$5\tfrac{5}{8} \times 4\tfrac{1}{2} = \tfrac{45}{8} \times \tfrac{9}{2}$$
$$= \tfrac{405}{16}$$
$$= 25\tfrac{5}{16}$$

How may a mixed number be changed to an improper fraction?

(b) By multiplying each part separately.

$$\begin{array}{rl} 5\frac{5}{8} & \\ 4\frac{1}{2} & \\ \hline 20 & (4 \times 5) \\ 2\frac{1}{2} & (4 \times \frac{5}{8}) \\ 2\frac{1}{2} & (\frac{1}{2} \times 5) \\ \frac{5}{16} & (\frac{1}{2} \times \frac{5}{8}) \\ \hline 25\frac{5}{16} & \end{array}$$

3. Mixed numbers with large integral parts usually have the fractional parts expressed in decimals; for example, a man might say that he lived $1\frac{3}{4}$ miles from the center of the city, but a railroad time-table gives the distance between Cincinnati and Cleveland as 261.7 miles.

4. (a) In stores goods are marked sometimes as $12\frac{1}{2}$ cents a pound or $87\frac{1}{2}$ cents a yard. But these prices are usually certain even parts of one dollar, called aliquot parts; as, $12\frac{1}{2}$ cents is $\frac{1}{8}$ of \$1.00 and $87\frac{1}{2}$ cents is $\frac{7}{8}$ of \$1.00.

(b) Because these prices are so common one needs to know the aliquot parts that are most used.

Aliquot Parts of a Dollar

$\frac{1}{2}$ of \$1 = \$.50	$\frac{1}{8}$ of \$1 = \$.12$\frac{1}{2}$
$\frac{1}{3}$ " " = .33$\frac{1}{3}$	$\frac{3}{8}$ " " = .37$\frac{1}{2}$
$\frac{2}{3}$ " " = .66$\frac{2}{3}$	$\frac{5}{8}$ " " = .62$\frac{1}{2}$
	$\frac{7}{8}$ " " = .87$\frac{1}{2}$
$\frac{1}{4}$ " " = .25	$\frac{1}{10}$ " " = .10
$\frac{3}{4}$ " " = .75	$\frac{3}{10}$ " " = .30
	$\frac{7}{10}$ " " = .70
$\frac{1}{5}$ " " = .20	$\frac{9}{10}$ " " = .90
$\frac{2}{5}$ " " = .40	
$\frac{3}{5}$ " " = .60	$\frac{1}{12}$ " " = .08$\frac{1}{3}$
$\frac{4}{5}$ " " = .80	$\frac{5}{12}$ " " = .41$\frac{2}{3}$
$\frac{1}{6}$ " " = .16$\frac{2}{3}$	$\frac{1}{16}$ " " = .06$\frac{1}{4}$
$\frac{5}{6}$ " " = .83$\frac{1}{3}$	$\frac{5}{16}$ " " = .31$\frac{1}{4}$

(c) Were all the possible thirds put in the table?

(d) Were all the possible fourths put in the table? If any one is omitted, show why it was unnecessary to put it in.

(e) Give the omitted aliquot parts under sixths, eighths, and tenths.

(f) Which of these aliquot parts are whole numbers?

5. (a) What are the prime factors of 100?

(b) A study of these prime factors will show why some of these aliquot parts end in halves and others in thirds or fourths.

$$100 = 2 \times 2 \times 5 \times 5$$

Since 100 contains two 2's and two 5's, it is evident that halves, fourths, fifths, and tenths of one hundred are whole numbers.

$$\frac{100}{4} = \frac{2 \times 2 \times 5 \times 5}{2 \times 2} = 25$$

$$\frac{100}{5} = \frac{2 \times 2 \times 5 \times \cancel{5}}{\cancel{5}} = 20$$

$$\frac{100}{10} = \frac{2 \times 2 \times 5 \times \cancel{5}}{2 \times \cancel{5}} = 10$$

(c) Why do the eighths end in $\frac{1}{2}$?

$$\frac{100}{8} = \frac{2 \times 2 \times 5 \times 5}{2 \times 2 \times 2} = \frac{25}{2} = 12\frac{1}{2}$$

(d) How many 2's are in the prime factors of 100? in the factors of 8?

(e) Show why sixteenths end in $\frac{1}{4}$.

(f) Which of these aliquot parts end in thirds? Factor these numbers and show why they must end in thirds.

6. What aliquot part of \$1.00 is each of the following amounts?

	(1)	(2)	(3)	(4)	(5)
(a)	\$.80	\$.12$\frac{1}{2}$	\$.66$\frac{2}{3}$	\$.16$\frac{2}{3}$	\$.10
(b)	.62$\frac{1}{2}$	.70	.83$\frac{1}{3}$	.33$\frac{1}{3}$	.41$\frac{2}{3}$
(c)	.06$\frac{1}{4}$	.30	.25	.37$\frac{1}{2}$	.08$\frac{1}{3}$
(d)	.40	.87$\frac{1}{2}$	.31$\frac{1}{4}$	.60	.75

7. What is a short way to multiply by $12\frac{1}{2}$? by $33\frac{1}{3}$? by $87\frac{1}{2}$? by $16\frac{2}{3}$? by $8\frac{1}{3}$? by $37\frac{1}{2}$? by $62\frac{1}{2}$? by $66\frac{2}{3}$?

V. Test Problems

Give an estimate of the following products, then multiply and compare results with the estimates.

	a	*b*	*c*	*d*	*e*	*f*
1.	$6\frac{1}{2}$	8	$3\frac{1}{2}$	$10\frac{1}{4}$	$15\frac{1}{3}$	12
	$\underline{4}$	$\underline{3\frac{1}{2}}$	$\underline{5\frac{1}{2}}$	$\underline{6}$	$\underline{6\frac{2}{3}}$	$\underline{4\frac{2}{3}}$
2.	$5\frac{4}{5}$	$10\frac{1}{4}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$15\frac{1}{2}$	$12\frac{1}{2}$
	$\underline{3}$	$\underline{5}$	$\underline{8\frac{3}{4}}$	$\underline{7\frac{1}{2}}$	$\underline{7\frac{1}{4}}$	$\underline{8}$

3.	$16\frac{2}{3}$	$17\frac{1}{2}$	.18	$16\frac{1}{4}$	$37\frac{1}{2}$	$16\frac{2}{3}$
	$8\frac{1}{2}$	8	$9\frac{1}{3}$	$5\frac{1}{2}$	$12\frac{1}{2}$	$8\frac{1}{3}$
4.	.50	$22\frac{1}{4}$	$25\frac{1}{8}$	.75	$.12\frac{1}{3}$	$24\frac{1}{2}$
	$5\frac{1}{2}$	$7\frac{1}{2}$	$14\frac{1}{2}$	$.08\frac{1}{3}$	$8\frac{1}{6}$	$7\frac{1}{4}$
5.	316.8	$110\frac{1}{2}$	214.6	204.7	84.9	$115\frac{1}{3}$
	$4\frac{1}{2}$	$2\frac{1}{3}$	$3\frac{1}{4}$	$2\frac{1}{2}$	1.8	$6\frac{2}{3}$
6.	410.7	156.8	429.66	18.6	18.7	320.5
	$8\frac{1}{3}$	$9\frac{1}{2}$	$5\frac{1}{2}$	$13\frac{1}{2}$	$8\frac{2}{3}$	5.5

7. If 1 yard of lace costs $12\frac{1}{2}¢$, what will $7\frac{1}{2}$ yards cost?

8. If pencils cost $50¢$ a dozen, what will $3\frac{1}{2}$ dozen cost?

9. Flour sells for $7\frac{1}{2}¢$ a pound. How much will 7 pounds cost?

10. Dressed turkey sells for $35\frac{1}{2}¢$ a pound. How much will a 10-pound turkey sell for? Chicken is worth $28\frac{1}{3}¢$ a pound. How much is a $5\frac{1}{2}$-pound chicken worth? Which is less expensive, one turkey or two chickens? How much less expensive?

11. The price of milk is $6\frac{1}{2}¢$ for a pint, if milk tickets are bought. If a pint of milk is used each day, what would be the amount of the January milk bill?

12. Meat is $27\frac{1}{2}¢$ a pound. What will a 5-pound roast cost?

13. Canned tomatoes sell for $12\frac{1}{2}¢$ a can in the store. What is the cost of a dozen cans? If tomatoes put up at home cost $7\frac{1}{4}¢$ a can, how much is saved on a dozen cans?

14. A boy works $1\frac{1}{2}$ hours after school each day and $3\frac{1}{2}$ hours on Saturday at the rate of $16\frac{2}{3}¢$ an hour. How much does he earn each week?

15. A girl needs $1\frac{2}{3}$ yards of lace for a large doily and $\frac{3}{4}$ of a yard for a small one. What will the lace for one large and six small ones cost at $37\frac{1}{2}¢$ a yard?

16. A girl buys tulip bulbs at $4\frac{1}{2}¢$ each. How much will $3\frac{1}{2}$ dozen cost?

G. RAPID CALCULATION IN DIVISION

I. Division of Integers and Decimal Fractions

1. What is division?

2. What name is given to the number to be divided?

3. What name is given to the number by which the other is divided?

4. What name is given to the result of division?

5. In all calculations, it is necessary to keep your figures well spaced and in the right places, but it is especially necessary in division.

6. Divide 7568 by 16.

$16\overline{)7568}$

Above which digit should the first figure of the quotient be placed?
How do you find what this first figure is?
How do you know that 5 is too large?

7. (a) Divide 75.68 by 1.6.

(b) Write this problem as a fraction, $\frac{75.68}{1.6}$.

(c) Multiply both numerator and denominator by 10. What change is made in the position of the decimal points?

$$\frac{75.68}{1.6} \times \frac{10}{10} = \frac{756.8}{16.}$$

(d) Does multiplying by $\frac{10}{10}$ change the quotient? Why?

(e) To divide by a decimal, it is most convenient to change the decimal point in the divisor so as to make it a whole number. If the decimal point in the dividend is moved to the right the same number of places, the quotient is not changed.

(f) Instead of erasing the decimal points, cancel them, and put others in the new positions.

(g) Before dividing, place the decimal point in the quotient directly over the new one in the dividend.

$$
\begin{array}{r}
47.3 \\
1/6.\,\overline{)\,75/6.8} \\
64 \\
\hline
11\ 6 \\
11\ 2 \\
\hline
48 \\
48 \\
\hline
\end{array}
$$

8. Divide 75.68 by .016.

How can you move the decimal point in the dividend the necessary three places to the right?

9. Divide 25,689 by 119.

$$
\begin{array}{r}
215\frac{104}{119} \\
119\,\overline{)\,25689} \\
238 \\
\hline
188 \\
119 \\
\hline
699 \\
595 \\
\hline
104
\end{array}
$$

The remainder from this division may be written over the divisor and added to the quotient. This is usually done when the remaining fraction can be changed to a simple one in halves, thirds, fourths, fifths, eighths, tenths, or even sixteenths. But such a fraction as $\frac{104}{119}$ is not easily handled, therefore it is customary to carry the division out to one, two, or three decimal places and then drop the remainder.

$$
\begin{array}{r}
215.87+ \\
119\,\overline{)\,25689.00} \\
238 \\
\hline
188 \\
119 \\
\hline
699 \\
595 \\
\hline
1040 \\
952 \\
\hline
880 \\
833 \\
\hline
47
\end{array}
$$

II. Division of Fractions and Mixed Numbers

1.
$$120 \div 8 = 15$$
$$120 \div 4 = 30$$
$$120 \div 2 = 60$$
$$120 \div 1 = 120$$
$$120 \div \tfrac{1}{2} = 240$$
$$120 \div \tfrac{1}{4} = 480$$
$$120 \div \tfrac{1}{8} = 960$$

2. (a) In the foregoing problems how does each divisor compare with the one before it?

(b) How does each quotient compare with the preceding one?

(c) Show why $120 \div 2 = 120 \times \tfrac{1}{2} = 60$.

(d) Show why $120 \div \tfrac{1}{2} = 120 \times 2 = 240$.

3. How may any problem in division be changed to one in multiplication?

4. How many eighths of an inch are in 1 inch? in $\tfrac{3}{4}$ of an inch? in $1\tfrac{1}{4}$ inches?

5. How many dish towels $\tfrac{5}{6}$ of a yard long can be cut from a 12-yard bolt of crash?

6. A sheet of tablet paper is $7\tfrac{1}{2}$ inches wide. Into how many spaces $\tfrac{3}{8}$ of an inch wide can it be ruled?

7. One piece of summer dress goods sells for $87\tfrac{1}{2}$¢ a yard. Another sells for $62\tfrac{1}{2}$¢. If a girl buys a dress from the first piece, how many times more expensive is it than one from the second piece?

8. What part of 4 is 2?

9. (a) What part of 7 is 5?

(b) What part of $\tfrac{7}{8}$ is $\tfrac{5}{8}$?

10. What part of $\tfrac{3}{4}$ is $\tfrac{3}{8}$?

11. What part of $\tfrac{2}{3}$ is $\tfrac{1}{6}$?

12. What part of $1\tfrac{1}{2}$ is $\tfrac{1}{4}$?

13. $\tfrac{3}{4}$ is what part of $1\tfrac{1}{2}$?

14. $\tfrac{3}{8}$ is what part of $1\tfrac{1}{2}$?

15. What part of $2\frac{1}{2}$ is $\frac{1}{4}$? $\frac{1}{8}$? $\frac{3}{8}$?

16. What is $48 \div 5\frac{1}{3}$?

17. What is $50 \div \frac{3}{4}$?

18. $37\frac{1}{2}$ is what part of 50?

19. What part of 50 is $12\frac{1}{2}$?

20. What part of a yard is 3 inches? $4\frac{1}{2}$ inches? 6 inches? $13\frac{1}{2}$ inches?

21. $1\frac{1}{2}$ feet is what part of a rod?

22. 330 feet is what part of a mile?

23. What part of a gallon is $2\frac{1}{2}$ pints?

24. (a) Make up ten practical problems in division of fractions and mixed numbers.

(b) Solve either your own problems or those of one of your classmates.

III. Short Cuts in Division

1. By changing the decimal point, how can you divide a number by 10? by 100? by 1000? by .1? by .01? by .001?

2. Think out a quick way of dividing by 200; by 500; by 25; by $12\frac{1}{2}$; by $33\frac{1}{3}$; by $16\frac{2}{3}$.

3. (a) In the problem on page 39 by continuing the division, we changed $\frac{104}{119}$ to its decimal equivalent, .87+.

(b) Any common fraction may be changed to a decimal form by dividing the numerator by the denominator.

$\frac{7}{16}$ = .43+ or .437+ or .4375

$$
\begin{array}{r}
.4375 \\
16\overline{)7.0000} \\
\underline{64} \\
60 \\
\underline{48} \\
120 \\
\underline{112} \\
80 \\
\underline{80}
\end{array}
$$

(c) We find that by carrying the division out four decimal places, it comes out "even," or without a remainder. The number of places the division is carried depends on how accurate the decimal needs to be. Evidently, if one is dealing in dollars and cents, two decimal places is sufficient. In that case $\frac{7}{16}$ would equal \$.44.

If one is dealing in the measures of fine instruments, the fraction must be accurate to the third, fourth, or fifth decimal figure.

4. (a) $\frac{7}{16}$ comes out even, in the fourth place, but some fractions never come out even, no matter how many places the division is carried.

(b) Change $\frac{7}{24}$ to a decimal.

$\frac{7}{24}$ = .29+ or .291+ or .2916+ or .29166+

$$
\begin{array}{r|l}
 & .29166+ \\
\hline
24 & 7.00000 \\
 & \underline{4\ 8} \\
 & 2\ 20 \\
 & \underline{2\ 16} \\
 & \quad 40 \\
 & \quad \underline{24} \\
 & \quad 160 \\
 & \quad \underline{144} \\
 & \quad\ 160 \\
 & \quad\ \underline{144} \\
 & \quad\ \ 16
\end{array}
$$

5. (a) There is an easy way to tell whether the division will come out even. The common fraction should always be in its lowest terms before it is changed to a decimal.

(b) The denominators of decimal fractions are:

10	100	1000
or	or	or
2×5	$2 \times 2 \times 5 \times 5$	$2 \times 2 \times 2 \times 5 \times 5 \times 5$

$$10{,}000$$

or

$$2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5 \times 5$$

(c) From the factors of these denominators of decimal fractions we find they contain only 2's and 5's.

(d) Write the fraction $\frac{7}{16}$ with its denominator factored.

$$\frac{7}{16} = \frac{7}{2 \times 2 \times 2 \times 2}$$

Since $\frac{7}{16}$ has only 2's in the denominator, it will come out an even decimal; and since there are four 2's in the denominator, the decimal form will have four decimal places.

(e)
$$\frac{3}{40} = \frac{3}{2 \times 2 \times 2 \times 5}$$

Since the denominator of 40 contains only the factors 2 and 5, the fraction may be changed to an even decimal. In its decimal form the fraction will have three decimal places because there are three 2's in the factors of the denominator.

6. (a) Write the fraction $\frac{7}{24}$ with its denominator factored.

$$\frac{7}{24} = \frac{7}{2 \times 2 \times 2 \times 3}$$

(b) Since the denominator of $\frac{7}{24}$ contains a factor 3, we know immediately that the fraction can never be changed to an even decimal. No fraction whose denominator contains a factor other than 2 or 5 can be changed to an even decimal.

(c) Every fraction whose denominator contains only the factors 2 and 5 may be changed to an even decimal by dividing the numerator by the

denominator. If there are three 2's or three 5's among the factors of the denominator, there will be three decimal places in the decimal fraction. If either factor occurs four or five times in the denominator of a fraction, there will be four or five decimal places in the decimal form of the fraction. In other words, a fraction will have as many decimal places in its decimal form as either factor 2 or 5 occurs in the denominator of its common fraction form.

7. Which of the following fractions can be changed to even decimals?

	(1)	(2)	(3)	(4)	(5)
(a)	$\frac{5}{8}$	$\frac{5}{12}$	$\frac{3}{16}$	$\frac{5}{18}$	$\frac{7}{24}$
(b)	$\frac{3}{4}$	$\frac{7}{15}$	$\frac{5}{36}$	$\frac{2}{3}$	$\frac{5}{6}$
(c)	$\frac{2}{7}$	$\frac{3}{25}$	$\frac{27}{80}$	$\frac{3}{125}$	$\frac{2}{9}$
(d)	$\frac{3}{5}$	$\frac{7}{20}$	$\frac{25}{27}$	$\frac{7}{30}$	$\frac{5}{21}$

(e) Change all possible ones to even decimals.

(f) Change all the others to decimals carried to three decimal places.

8. How to tell whether one number can be divided by another evenly:

(a) (1) If a number ends in 0, 2, 4, 6, or 8, it is divisible by 2.

(2) What name is given to numbers ending in these digits?

(3) What name is given to numbers ending in any of the other digits?

(4) Which of the following numbers are divisible by 2?

2358	972	663
245	1447	1009
1000	881	190
586	124	3338

(b) (1) If the sum of the digits can be divided by 3, the number itself can be divided by 3.

(2) In 2358 the sum of the digits $2+3+5+8=18$. 18 can be divided by 3. Therefore 2358 can be divided by 3.

(3) Which of the following numbers can be divided by 3?

231	102	43,098
7554	1620	43,698
15152	8989	43,598
9037	28989	143,598

(c) (1) If the number formed by the two right-hand digits of a number can be divided by 4, the number itself can be divided by 4.

97,624 can be divided by 4 because 24 can be so divided.

A number ending in two zeros, as 700, is divisible by 4.

(2) Which of the following numbers can be divided by 4?

79086	128	5464
79084	9196	6454
2222	3742	33332
2616	778	5000

(d) If a number can be divided by 5, it must end in one of two digits. Which digits are they?

(e) (1) A number can be divided by 6 if it is an even number and if it can be divided by 3.

(2) Show why the tests for both 2 and 3 must hold for 6.

(3) Which of the following numbers can be divided by 6?

48,138	63,354	60,603
590,736	2,836	20,206
16,048	32,121	20,406
22,624	30,309	3,789

(f) There is no simple test of divisibility by 7.

(g) (1) A number is divisible by 8 if the number formed by its last three digits is divisible by 8, or if its last three digits are zeros. $906\overline{528}$ is divisible by 8 because 528 can be divided by 8.

(2) Why is 1000 divisible by 8?

(3) Which of the following numbers are divisible by 8?

145,824	267,804	125,992
2,069,872	50,600	67,000
105,000	22,000	123,456
93,400	125,998	1,234,560

(h) (1) A number is divisible by 9 if the sum of its digits is divisible by 9.

(2) Why does this divisibility test resemble the test for 3?

(3) Which of the following numbers are divisible by 9?

504	756	333
26,748	8,001	112,788
4,899	1,602	91,612
56	20,502	12,345,678

(i) (1) To be divisible by 10 a number must end in a certain digit. Which digit is it?

(2) How does this divisibility test compare with the one for 5?

(j) There are two tests for the divisibility of a number by 11.

(1) If the sum of the odd digits of a number is equal to the sum of the even digits, the number is divisible by 11. Thus, $1\overset{\frown}{0}6\overset{\frown}{3}4\overset{\frown}{8}$ is divisible by 11, since $8+3+0=4+6+1$.

(2) If the difference between the sum of the odd digits and the sum of the even digits is divisible by 11, the number is divisible by 11. In $2\overset{\frown}{9}0\overset{\frown}{8}1\overset{\frown}{8}$ the sum of the odd digits is $8+8+9$, or 25; the sum of the even digits is $1+0+2$, or 3. The difference between these sums is 22. Since 22 is divisible by 11, 290,818 is divisible by 11.

(3) Which of the following numbers is divisible by 11?

43,369	12,345,678	88
63,349	12,435,687	888
670,428	111,111	297
2,343	111	490,919

IV. Proofs of Division

1. The first proof for division is by multiplication.

Dividend = Divisor × Quotient.

What two numbers must be multiplied? What must their product equal? What must be done with the remainder, if there be one?

2. The second proof is by casting out nines.

Divide 51,892 by 127.

$$
\begin{array}{r}
408 \\
127\overline{)\,51892} \\
\underline{508} \\
1092 \\
\underline{1016} \\
76
\end{array}
$$

	Excess of 9's
In divisor = 1	$3 \times 1 = 3$
In quotient = 3	
In remainder =	4
In dividend =	7

If there is a remainder in division, then,

Dividend = (Divisor × Quotient) + Remainder.

Give this statement in a complete sentence.

Therefore,

$$\begin{matrix}\text{The excess}\\ \text{of 9's in}\\ \text{Dividend}\end{matrix} = \left(\begin{matrix}\text{The excess}\\ \text{of 9's in}\\ \text{Divisor}\end{matrix} \times \begin{matrix}\text{The excess}\\ \text{of 9's in}\\ \text{Quotient}\end{matrix}\right) + \begin{matrix}\text{The excess}\\ \text{of 9's in}\\ \text{Remainder}\end{matrix}$$

3. The third proof is by division.

Show that the

Dividend ÷ Quotient = Divisor.

V. Test Problems

Estimate the quotients of the following:

	a	*b*	*c*	*d*
1.	$1.7\overline{)42.59}$	$.024\overline{)87.94}$	$.12\overline{)33.19}$	$1.5\overline{)769.7}$
2.	$2.1\overline{)61.23}$	$.013\overline{)4156}$	$.018\overline{)591.6}$	$19.2\overline{)3.924}$
3.	$.023\overline{)7942}$	$3.6\overline{)4873}$	$.42\overline{)6.194}$	$5.5\overline{).1149}$
4.	$11.6\overline{)37694}$	$.34\overline{)693.86}$	$1.2\overline{)137.42}$	$.14\overline{)23.496}$
5.	$2.5\overline{)375.92}$	$3.2\overline{)4.3561}$	$.44\overline{)56874}$	$.027\overline{)68.934}$

6. Find the exact quotients of the problems above and check each.

7. Fill in all the blanks in the following record:

	Sales	Expenses	Profits
Jan.	$ 875.15	$ 618.74	.....
Feb.	730.86	534.98	.....
Mar.	981.14	875.86	.....
Apr.	907.16	725.49	.....
May	1015.87	846.92	.....
June	849.48	632.16	.....
July	786.87	594.98	.....
Aug.	738.51	521.25	.....
Sept.	968.88	779.89	.....
Oct.	1364.42	1050.18	.....
Nov.	1258.33	949.64	.....
Dec.	1492.68	1187.13	.....
Total			
Average			

8. Divide the following, using a short cut for each:

	Dividend	Divisor	Quotient
(a)	386.7	10	.....
(b)	47.53	0.1	.....
(c)	568.4	0.01	.....
(d)	874.78	0.001	.....
(e)	8476.24	200	.....
(f)	38.754	500	.....
(g)	6844	25	.....
(h)	3875	$12\frac{1}{2}$	.....
(i)	49688	$33\frac{1}{3}$	.....
(j)	7643	$16\frac{2}{3}$	.....
(k)	1689	0.001	.....
(l)	28460	200	.....
(m)	7500	$12\frac{1}{2}$	.....
(n)	6.247	0.1	.....
(o)	104200	500	.....
(p)	10.87	0.01	.....
(q)	8.656	$16\frac{2}{3}$	.....
(r)	986.3	$33\frac{1}{3}$	.....
(s)	.0461	10	.....
(t)	337.90	25	.....

9. (a) Write twenty common fractions.
(b) Choose the ones which can be changed to even decimals.
(c) Change these to decimal fractions.
(d) Change the others to decimals carrying the division to three decimal places.

CHAPTER TWO

EVERYDAY ARITHMETIC IN BUSINESS

A. BUYING FOR CASH

I. Sales Slips

1. When one goes to the grocery, dry goods, or any other kind of store, the clerk writes down a list of the articles bought with the amount and cost of each article. The list is written on a slip of paper that is printed for the purpose. The slips are usually made in duplicate by using carbon paper between. One slip is given to the customer, the other is filed for a record of the store's business. A sales slip is sometimes called an invoice. At the top of the slip is printed a "heading." Some headings have just a few items that are needed on all sales slips, as follows:

(a) Name of the store.
(b) Name of the city.
(c) Telephone numbers.
(d) Blank line for the date of sale.
(e) Blank lines for the name and address of the purchaser, for use if the goods are to be delivered or charged.

In large department stores, sales slips have several other items necessary to keep track of the business properly.

2. Examine the headings of sales slips to see what additional items are given.

3. (a) Bring sales slips from different stores to school and compare them.
(b) Show why each item in the heading is necessary.

4. (a) Below the heading are lines on which the clerk lists the articles purchased, with the price of each article, the total cost of each, and the total amount for all.

(b) Examine some sales slips or their illustrations and note carefully how they are ruled.

(c) How many vertical lines are on the left side? What is this column used for?

(d) How many vertical lines are on the right side? What are these columns used for?

(e) The total amount of each purchase, placed in the two right-hand columns, is called the *extension* of the item.

(f) The sum of the extensions of all the items gives the total amount of the sale. It is sometimes called the *footing*.

5. Extend and foot the following sales, *a* and *b* of a grocery, *c* of a dry goods store, and *d* of a hardware store:

Quantity	Articles	Price	Extension		Quantity	Articles	Price	Extension	
	a					*b*			
2	loaves bread	10	...	20	$2\frac{1}{2}$	chicken	40	...	...
$1\frac{1}{2}$	sugar cookies	14	...	21	1	coffee	33	...	...
$1\frac{1}{2}$	apples	85	1	28	$1\frac{1}{2}$	eggs	62	...	...
$\frac{1}{2}$	potatoes	1 88	...	94	$\frac{1}{2}$	butter	63	...	...
$\frac{3}{4}$	prunes	24	...	18	1	oleomargerine	37	...	...
2	sausage	30	...	60	10	soap for	59	...	59
$\frac{1}{2}$	bacon	65	...	33	$\frac{1}{4}$	almonds	79	...	...
$\frac{1}{2}$	cheese	38	...	19	2	grape fruit	$12\frac{1}{2}$	...	...
1	eggs	62	...	62	2	rolled oats	12	...	...
1	coffee	30	...	30	5	sweet potatoes	05	...	...
6	soap	07	...	42					
			5	27					
	c					*d*			
$1\frac{1}{2}$	yd. beading	10	...	...	1	small kitchen knife	25	...	...
5	yd. lace	19	...	...	1	egg beater	48	...	...
$5\frac{1}{4}$	yd. beading	15	...	...	1	double boiler	1 48	...	...
$2\frac{1}{2}$	yd. insertion	15	...	...	3	cake pans	$07\frac{1}{2}$	...	...
$2\frac{1}{2}$	yd. lace	18	...	...	$1\frac{2}{3}$	doz. plates	2 00	...	...
2	cards clasps	10	...	...	$1\frac{2}{3}$	doz. cups & saucers	4 75	...	...
10	yd. long cloth	$37\frac{1}{2}$	...	...					

6. (a) Suppose a relative gave you $20 to spend exactly as you please; what would you buy?

(b) Make out a bill or bills of your purchases. Find total.

7. (a) Mary and her mother buy the following materials for a dress:

4 yd. satin	$2.00
$\frac{3}{4}$ yd. trimming	1.50
$1\frac{1}{2}$ yd. lining	.37$\frac{1}{2}$
1 card hooks and eyes	.10
2 cards snaps	.10
2 spools silk thread	.10
1 spool cotton thread	.05
2 doz. buttons	.75
1 pattern	.20

(b) Make out the bill and find the amount.

(c) Instead of buying a dress readymade for $25.00, how much will Mary and her mother save if they make it themselves?

8. If possible get some blank sales slips and make out slips for the purchases given below. If you cannot obtain blank slips, rule some on blank paper. Put in a correct heading, representing yourself as the proprietor of the store. If you were the proprietor, how accurate would you want the clerk to be in extending and footing the slip?

(a) Grocery Store

$\frac{1}{2}$ lb. bacon	$ .50
1 lb. butter	.45
1 can baking powder	.25
$\frac{1}{4}$ lb. tea	1.00
2 cans tomatoes	.12$\frac{1}{2}$
2 lb. meal	.06$\frac{1}{2}$

(b) Drug Store

$1\frac{1}{2}$ oz. vanilla	$ .10
2 castile soap	$.13\frac{1}{2}$
1 pt. olive oil	.90
3 tooth brushes	.25
1 magazine	.15

(c) Jewelry Store

2 tablespoons	$2.00
1 pin	6.00
1 bill case	3.50
1 tea ball	4.00
Watch repaired	.50
1 hat brush	2.50

(d) Book Store

2 notebooks	$ .23
1 textbook	1.25
1 doz. pencils	.50
1 eraser	.05
1 ruler	.10
2 magazines	.25

(e) Hardware Store

1 oil mop	$ .75
1 bread box	2.00
2 kitchen spoons	.10
1 egg beater	.25
1 ice box	8.95
1 screw driver	.25

(f) Grocery Store

12 lb. flour	$ $.07\frac{1}{2}$
1 lb. butter	.55
3 lemons for	.10
$1\frac{1}{2}$ lb. bacon	.45
4 lb. beef	.35

1 head lettuce	.15
2 doz. eggs	.48
$\frac{1}{2}$ lb. pecans	.40
1 pk. potatoes	1.40 bu.
2 bread	.10
2 pkg. oatmeal	.12$\frac{1}{2}$
2 lb. Crisco	.33
5 lb. meal	.07$\frac{1}{2}$

(g) Book Store

Book on electricity	$1.00
2 pencils	.05
1 ruler	.25
1 notebook	.25
1 magazine	.35
1 textbook	.53
1 book strap	.50

(h) Dry Goods Store

2$\frac{1}{2}$ yd. ribbon	$ .35
5$\frac{1}{2}$ yd. lace	.25
3 hdkchfs.	.25
3$\frac{1}{2}$ yd. insertion	.18
1 pr. gloves	1.25
2 pr. hose	.75

(i) Hardware Store

1 tennis racket	$5.00
2 tennis balls	.50
1 pr. tennis shoes	1.50
1 baseball	1.25
1 bat	1.00

(j) Grocery Store

1 bottle pickles	$ .15
1 bottle olives	.20

$\frac{1}{2}$ doz. eggs	.55
1 bread	.10
$\frac{1}{4}$ lb. butter	.60
$\frac{1}{2}$ lb. sliced ham	.60

9. Why are sales slips not given with every purchase in all stores?

10. What is a cash register? What are the advantages to the proprietor of a store in having a cash register?

B. BUYING ON CREDIT

I. Monthly Statement

1. Many stores do not require that their regular customers pay cash for each purchase. It is often more convenient to pay by the week or by the month. In that case, the bookkeeper for the store keeps a record or an account of all the purchases and sends a bill or statement of the account to the customer at the end of the month. The customer keeps his sales slips and checks up the bill before paying it. If a customer has his purchases charged, the sales slip is sent for approval to the Credit Department before he is permitted to take the goods. If the purchaser is known as a reliable customer, the slip is returned to the clerk with "O. K." or "approved" stamped on it. Then the clerk delivers the goods and the slip to the customer.

2. A statement of account is somewhat like a sales slip. It has a heading, but there are a few more items on it. The statement or bill is usually on a larger sheet of paper.

3. (a) Examine the headings of several bills, either of some you have brought from home or of those illustrated.

(b) What do you find on the bill that is not on the sales slip?

(c) What is omitted on the bill that is on the sales slip?

GEORGE & SONS
IMPORTING RETAILERS
DRY GOODS AND GARMENTS
Selma, Wisconsin

SOLD TO Miss Mary Beard
495 Forest Street
City

September 1, 1918

Date	Clerk No.	Description	Charges	Credits
Aug.				
1	174	1 pr. shoes repaired	$ .50	
3	174	2 pr. pumps repaired	.35	
20	187	1 pr. overshoes	1.00	
			$1.85	

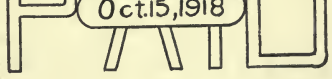
Tazewell, Mississippi
October 1, 1918

Miss Elizabeth Strain
1418 Rose Avenue

BOUGHT OF F. W. CHAMBERLAIN CO.

July	25	1 doz. half-pint jars	78	
Aug.	31	1 set irons	1 50	
		1 dish	65	
Sept.	6	1 oil mop	75	3 68

F. W. Chamberlain Co.



C. HOW PAYMENTS ARE MADE

I. In Cash or by Check

1. When a person receives the monthly statement, how may he pay the bill?

(a) He may go to the store and pay cash or give a check on a bank.

(b) He may mail a check.

2. Why is it never wise to send money in a letter?

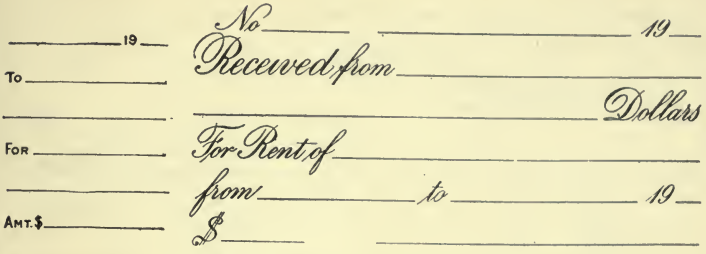
Other ways of sending money to distant places will be discussed later.

3. No matter how the bill is paid, the dealer gives the customer a receipt. It may be in one of several forms.

(a) "Received payment" or "Paid" may be written or stamped upon the bill, with the date and name of the firm. If a clerk receipts a bill, he signs the firm's name and adds "per" with his own name or initials. *Per* is a Latin word meaning *through* or *by*.

(b) After the check has been cashed, it is returned through the bank to the customer, as a canceled check. Such a check is a receipt, for it must be signed on the back by the firm or person to whom it was made out. In order to save postage many business houses do not send receipted bills to their customers except upon request.

(c) Some business houses have little booklets of blank forms for receipts, on which the names, dates, and amounts may be quickly written.



Blank Form for Receipts

4. (a) Examine the statements given below.
(b) Compare their headings and rulings.
(c) Note the various ways of receipting the bills.

---

(1)

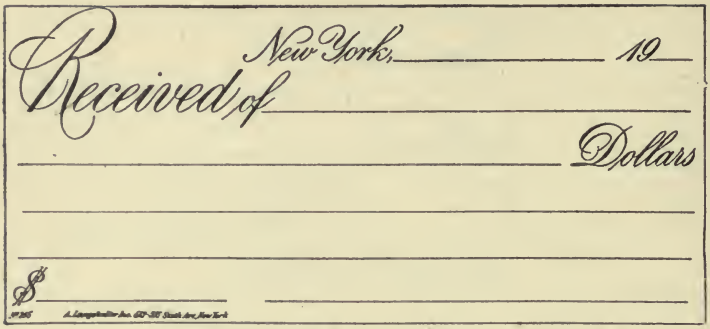
MARGARET WADE
Millinery
VIRGINIA NATIONAL BANK BUILDING
FRANKLIN, VIRGINIA

Sold to
Miss A. Markley
1418 Candler Street

1920		Charges	Credit	Net
Mar. 23	Hat	$12.50		
	Veil	.50		13.00

PAID
Apr. 6, 1920
Margaret Wade
Per_____

Invoice from Margaret Wade paid by check No. ——— 191—



BLANK FORM FOR RECEIPTS

(2) THE J. A. MYERS COMPANY
DRY GOODS
Nashville, Nebraska

SOLD TO Miss Claudia Ashton
215 West Walnut Street

Date	Items	Debits	Credits	Balance
1920				
Aug. 30	1 pr. oxfords	4.50		
Sept. 4	1 pr. gloves	2.00		
6	6 handkerchiefs	1.50		
7	1 pr. gloves		2.00	
19	6 dish towels	1.80		
24	2 sheets	4.20		
30	1 bedspread	6.00		18.00
	PAID OCT. 2, 1920 The J. A. Myers Co.			

(3) STATEMENT

Cherokee, Alabama, 8/13, 1920

THE JACOB DRUG COMPANY

SOLD TO Miss Johnson
2618 Spring Street

	Acct. Rendered		35	
7/6/20	4 oz. menthol		25	
	Olive oil		39	
	Toothbrush		25	
	Rubber tubing		25	
	Magazine		15	
7/10/20	Ink remover		19	1 83
	Rec'd Payment The Jacob Drug Co. per *E. M. R.*			

(4) August 1, 1920

HOPE BROS.
76 N. MAIN STREET

SOLD TO Miss Mabel Woods
318 Holston Avenue
City

Jewelers and Platinumsmiths Jackson, Ohio

			Charge	Credit	Balance
1920	Account Rendered				
July 17	To restring beads		50		
19	To repair watch		35		
24	Bar pin		4 50		
31	Wrist watch		16 50		21 85

HOPE BROS 8-3-20 PAID CB

(5) THE J. & K. ALLEN COMPANY

MONTH OF June, 1920

SOLD TO Miss Julia Smith
1314 Linden Avenue
City

Date	Sales Person	Description		Charges		Credits	
5/29	54	2 bags			70		
6/4	54	1 doz. buttons	1.50				
		1 doz. buttons	.98	2	48		
6/8	374	1 petticoat	2.50				
		1 waist	5.00	7	50		
6/11	61	$1\frac{1}{2}$ yd. beading	.15				
		5 yd. lace	.95				
		$5\frac{1}{4}$ yd. beading	.79				
		$2\frac{1}{2}$ yd. insertion	.38				
		Lace	.45	2	72		
6/12	24	1 belt		2	00		
6/15	53	$\frac{2}{3}$ doz. buttons	.66				
		2 thread	.10		76		
				16	16		

The J+K Allen + Co.
July 6,1920.

D. THE MAKING OF MONTHLY STATEMENTS

From the memoranda given below make out in correct form the monthly statements. Fill in suitable headings. Mark the bills paid.

1. Aug. 7, 1920 5 yd. voile..... $ .75
1 yd. net..... .35
2 cards clasps..... .10
1 spool thread..... .05
10 1 pr. shoes..... 5.00
2 pr. hose..... .50

		15	1 pr. gloves	1.00
		17	12 yd. longcloth	.37½
		19	6½ yd. lace	.20
			4½ yd. insertion	.18
			3 yd. beading	.18
		24	6 handkerchiefs	.25
		28	1 purse	5.00
2.	April	1921	Account rendered	$4.50
	May	1, 1921	1 double boiler	1.75
			2 cake pans	.25
			1 measuring cup	.30
		10	1 gas stove	25.00
		15	1 set irons	.75
		18	1 hammer	.50
		22	2 kitchen spoons	.20
		28	1 ironing board	1.25
3.	Oct.	3, 1920	1 bookcase	$25.00
			1 magazine stand	4.50
		7	1 rag rug	3.75
		9	2 kitchen chairs	1.75
		14	1 desk lamp	2.75
		16	Return desk lamp	2.75
		17	2 pr. curtains	5.98
4.	Sept.	6, 1921	English book	$ 1.00
		8	2 tablets	.05
			1 notebook	.23
			6 pencils	.05
		15	1 magazine	.15
			6 pen points for	.05
			1 penholder	.10
		19	French book	.53
		25	Writing paper	.50
5.	Oct.	7, 1921	2 doz. buttons	$ .35
			4 thread	.05
			1 hooks & eyes	.10

	10	2 sheets	1.80
	12	3 yd. linen	2.00
		6 towels	.50
	15	4 yd. gingham	.35
		1 pattern	.15
	18	1 umbrella	1.50
	20	1 collar	.50
	21	Return umbrella	1.50
		1 umbrella	2.50
	25	1 pr. overshoes	.75
6. Dec.	1, 1920	2 yd. white goods	$ .37½
		2 yd. insertion	.30
	4	6 handkerchiefs	.19
		7½ yd. lace	.15
	10	1 purse	3.75
		1 bill case	.50
	14	4 towels	.75
		6 wash cloths	.10
	18	1 dresser scarf	.75
	20	1 pillow	.75
		2½ yd. cretonne	.35
	23	Necktie	.50
		Gloves	1.00
7. Jan.	3, 1921	1 knife	1.25
	6	1 kitchen clock	1.50
	7	1 pr. skates	3.00
	10	1 sled	1.50
	15	1 pr. scissors	1.25
	19	1 mixing bowl	.50
		2 plates	.50
		1 spoon	.15
	25	1 bread box	2.50
	28	1 towel rack	.50
	29	Return bread box	2.50

E. USE OF MONEY AND BANKS IN BUSINESS

I. What Gives Money Its Value?

1. (a) You have learned that bills are paid either in cash or by check.
(b) What is money?
(c) Why is it needed?
(d) What was used for money by the early American settlers in trading with the Indians?
(e) Name different articles that different peoples have used as money.
(f) What makes a little slip of paper worth one, five, ten, or more dollars, just because the Government has marked it so?
(g) Are people always willing to accept paper money or currency instead of gold or silver?
(h) Has there ever been a time in the history of our country when certain paper money would not be accepted? Why?

2. (a) Primitive people have different ways of hiding their money. Can you tell about some of them?
(b) Among civilized people, certain men go into the business of keeping other persons' money safe. Such men are bankers.
(c) Their business is banking.
(d) Their place of business is called a bank.
(e) Describe some bank and tell how the money is kept safe.
(f) Inquire of some business men the difference between private banks, state banks, national banks, and Federal Reserve banks.
(g) Which kind is the safest?

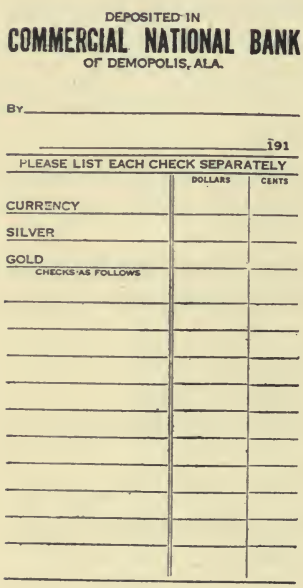
II. Opening a Bank Account

1. (a) What is meant by opening an account at a bank?

(b) One who puts money in a bank is a *depositor*. The money put in is a *deposit*. (*Deposit* comes from a Latin word which means *to put* or *to place*.)

(c) On opening an account, each depositor is given a little blank book in which each deposit is recorded. That blank book is really a receipt for the money.

(d) To make a deposit, one fills out a deposit slip, furnished by the bank, and gives it with the money and bank book to a bank clerk, called a *teller*. The teller checks up your deposit slip with the money, and records the amount with the date in your book.

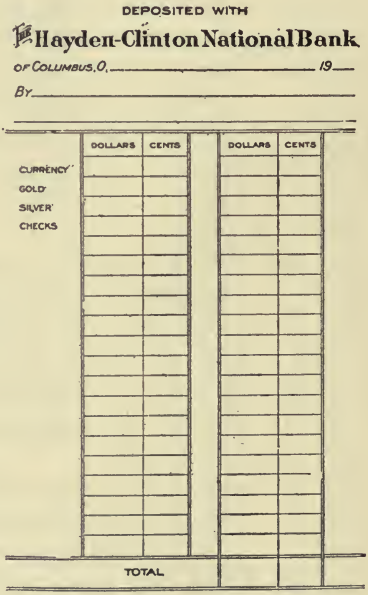

DEPOSITED IN
COMMERCIAL NATIONAL BANK
OF DEMOPOLIS, ALA.

BY _____

_____ 191

PLEASE LIST EACH CHECK SEPARATELY

	DOLLARS	CENTS
CURRENCY		
SILVER		
GOLD		
CHECKS AS FOLLOWS		


DEPOSITED WITH
The Hayden-Clinton National Bank
OF COLUMBUS, O. _____ 19__

BY _____

	DOLLARS	CENTS	DOLLARS	CENTS
CURRENCY				
GOLD				
SILVER				
CHECKS				
TOTAL				

CLEARING HOUSE MEETS AT 11 00 A.M
ITEMS RECEIVED AFTER 10.00 O'CLOCK WILL BE CREDITED SUBJECT TO PAYMENT NEXT DAY

2. There are two kinds of bank accounts. One is a commercial account, from which you may draw money at any time. The other is a savings account, from which you may draw money only under certain conditions. Savings accounts will be taken up later.

3. (a) If you have money on deposit in a bank, you do not need to go to the bank, draw the money, and take it to the store to pay a bill. You may write an order telling the bank to pay the person or firm the amount of your bill.

(b) Such an order is called a *check*.

(c) Banks furnish their depositors with check books. These contain blank checks which the depositor fills in as needed.

(d) Attached to the check is a *stub* on which one keeps his own record of his deposits, checks, and balance in the bank.

4. (a) Bring samples of checks from different banks.

(b) Examine the illustrations on page sixty-seven and note carefully how a check is made out.

(c) Why should the number of dollars be written at the extreme left or have a line in front of it?

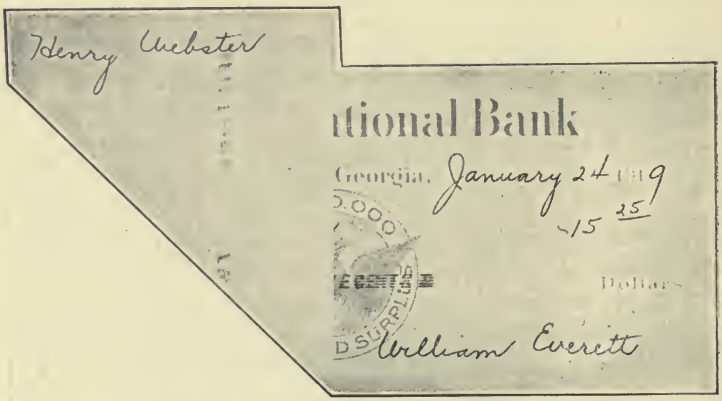
(d) Why should a line be drawn after the number of dollars?

(e) If the amount of the check does not include cents, why should $\frac{\text{no}}{100}$ or $\frac{00}{100}$ follow the number of dollars?

5. (a) When a merchant receives a check in payment of a bill, what does he do with it?

(b) First of all he must credit the customer's account with the amount of the check.

(c) A check reads "Pay to the order of ————." The merchant writes that order by signing his name on the back of the check, thus:



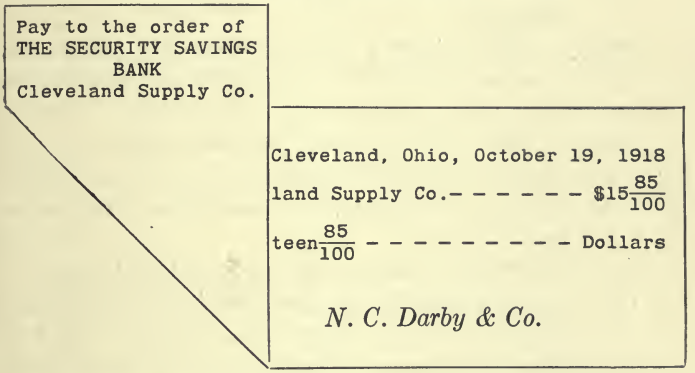
(d) Such a signature on the back of a check is called an *indorsement.*

(e) After indorsing the check, the merchant may present it at any bank where he is known and

receive cash to the amount the check calls for. Or, he may deposit the check just as he would deposit money, and the amount will be credited to his account.

(f) After a check is indorsed one must be careful not to lose it, for then anyone may have it cashed, because the indorsement is an order for it.

6. Business houses usually deposit all checks received instead of cashing them. Therefore, to avoid the trouble of writing the firm's name on so many checks, and to avoid the danger of losing them, they stamp an indorsement making the check payable to their bank.


Pay to the order of
THE SECURITY SAVINGS
BANK
Cleveland Supply Co.
Cleveland, Ohio, October 19, 1918
land Supply Co.- - - - - - $15 85/100
teen 85/100 - - - - - - - - - Dollars
N. C. Darby & Co.

7. (a) Ask some business man to explain to you what a Clearing House is.

(b) Ask him what part of the business in your community is done through a bank.

F. BUSINESS ORGANIZATION AND PRACTICE

I. Measuring Profits in Hundredths

1. (a) What is business?

Business is largely making, buying, and selling something that other persons want.

(b) What does the farmer sell?
(c) What does the workman sell?

2. (a) Make a list of the most important kinds of business and tell something interesting about each.
(b) What special training and ability is required in each?
(c) Which ones offer the best chances for success?
(d) Which kind would you choose for yourself? Why?

3. (a) Organize your class into a little city, with different members engaging in various kinds of business. Be sure that all kinds necessary for the community are represented.
(b) Either toy money or marked slips of paper may be used.
(c) To carry on your business as grown people do, you will, of course, have a bank and use checks.

4. (a) Suppose one pupil goes into the grocery business.
(b) In order to buy all the necessary fixtures and a complete stock of groceries, he must put $6000 in the business, at the start, half in fixtures and half in stock.
(c) This $6000 is the *capital* put into the business.
(d) The grocer turns over his stock four times during the year, thus having a total income of $12,000.
(e) Out of this amount of sales, he must take all the expenses of running the business.
These items include:

Rent.....$ 600
Clerk hire..... 3000
(1 clerk, 1 meat cutter, 1 delivery man.)
Delivery..... 1000
(Upkeep of truck, garage, etc.)
Grocer's salary..... 2400
(What he could earn if working for someone else.)

Miscellaneous expense. 1000
(Telephones, stationery, twine, paper, advertising.)

(f) How much is left as profit on the investment for the proprietor?
(g) What part of the total sales is spent on rent?
(h) What part of the total sales is spent on each of the other items of expense?
(i) What part of the sales is left as profit on the investment?
(j) The rent is $\frac{6000}{120000}$ or $\frac{1}{20}$ of the sales.
(k) The clerk hire is $\frac{30000}{120000}$ or $\frac{1}{4}$ of the sales.
(l) The delivery is $\frac{1000}{120000}$ or $\frac{1}{12}$ of the sales.
(m) The grocer's salary is $\frac{24000}{120000}$ or $\frac{1}{5}$ of the sales.
(n) The miscellaneous expense is $\frac{10000}{120000}$ or $\frac{1}{12}$ of the sales.
(o) The profit is $\frac{40000}{120000}$ or $\frac{1}{3}$ of the sales.

5. It is easier to compare these fractional parts if the fractions are expressed as decimals. Carry each one to two decimal places.

(a) The rent is $\frac{1}{20}$ or .05 of the sales.
(b) The clerk hire is $\frac{1}{4}$ or .25 of the sales.
(c) The delivery is $\frac{1}{12}$ or .08$\frac{1}{3}$ of the sales.
(d) The grocer's salary is $\frac{1}{5}$ or .20 of the sales.
(e) The general expense is $\frac{1}{12}$ or .08$\frac{1}{3}$ of the sales.
(f) The profit is $\frac{1}{3}$ or .33$\frac{1}{3}$ of the sales.
(g) Which of these items is the largest, as shown by these fractional parts?
(h) Which is the smallest?
(i) Which set of fractions did you use to make these comparisons?
(j) In business, men have found it best to figure all their expenditures as so many hundredths of the total sales.

6. (a) The grocer's profit is what part of the total sales?
(b) What part of the original capital did the grocer make in his year's profits?

7. (a) Suppose another pupil puts \$15,000 capital into the dry goods business. His total sales for the year are \$20,000. After taking out the expenses, he finds he has a profit of \$8000.
(b) Which man has the better investment, the grocer or the dry goods merchant?
(c) If you think of the profits only in figures of \$4000 and \$8000, you would say that the dry goods business is the better. But that is not the true way to compare them.
(d) The grocer's profits are \$4000 on \$6000 capital. That is, his profits are $\frac{4000}{6000}$ or $\frac{2}{3}$ or $.66\frac{2}{3}$ of his capital.
(e) The dry goods merchant's profits are \$8000 on \$15,000 capital. That is, his profits are $\frac{8000}{15000}$ or $\frac{8}{15}$ or $.53\frac{1}{3}$ of his capital.
(f) How can you tell which is the more profitable business?
(g) If you consider the one man's profit as $\frac{2}{3}$ of his capital and the other as $\frac{8}{15}$ of his capital, it is difficult to say which is the better, until $\frac{2}{3}$ and $\frac{8}{15}$ are changed to fractions having a common denominator, $\frac{10}{15}$ and $\frac{8}{15}$.
(h) In this form which parts of these fractions tell you which business is the better?
(i) In most cases, it is still easier to use 100 as the common denominator, which is the same as writing the fractions in decimal form, $.66\frac{2}{3}$ and $.53\frac{1}{3}$.
(j) A profit of $66\frac{2}{3}$ hundredths of one's capital is better than $53\frac{1}{3}$ hundredths.

8. (a) Since *hundredths* is a long hard word, business men use in its place two Latin words *per cent.*

(b) *Per* means *out of* or *by; cent* is a short form of *centum*, meaning *one hundred.*

9. (a) The grocer's profit is $66\frac{2}{3}$ hundredths, or $66\frac{2}{3}$ per cent of his capital.

(b) The dry goods merchant's profit is $53\frac{1}{3}$ hundredths or $53\frac{1}{3}$ per cent of his capital.

10. (a) What per cent of the grocer's sales did he pay for rent?

(b) What per cent for clerk hire?

(c) What per cent for delivery?

(d) What per cent for his own salary?

(e) What per cent for general expenses?

(f) What per cent of his sales was his profit?

11. In this way each pupil, representing a different business, will:

(a) Decide how much capital he will put in.

(b) Estimate the amount of sales and the main items of expense.

(c) Find what part of the sales each item is.

(d) Find what per cent of the sales each item is.

(e) Find what part of the sales his profit is.

(f) Find what per cent of the sales his profit is.

(g) Find what per cent of his capital his profit is.

(h) If possible, talk to some person in the business he has chosen and find out what these estimates should be.

12. (a) A prominent business man once said, "A successful man always thinks in per cents, not in figures."

(b) Show how this is true.

(c) Which is more expensive for a shoe dealer, to put an 8-cent lace in a $12 pair of shoes or to put a 5-cent lace in a $6 pair?

II. History of Per Cent Sign

1. (a) All pupils have been familiar with per cents as grades on certain papers.

(b) If you solved 8 out of 10 problems in arithmetic, your paper was given a grade of 80 per cent. $\frac{8}{10} = \frac{80}{100} = .80 = 80$ per cent.

(c) How would your teacher grade a spelling paper which had 17 out of 20 words correct?

(d) Would she write out the words *per cent* after each grade?

(e) What sign for *per cent* does she always use?

(f) What are the advantages of using the sign instead of the words?

(g) The use of this sign or shorthand way of writing *per cent* came about gradually.

At first 5 per cent was shortened to 5 per 100. Later it was $5\,\frac{0}{0}$. Then 5 0/0. If the last sign is written rapidly, it easily grows into %, the sign now in common use.

III. Use and Graphs of Per Cent

1. (a) If an arithmetic lesson has ten problems of which you solved seven correctly, what part of the lesson was correct?

(b) What per cent should it be marked?

2. (a) The following is a pupil's record in arithmetic for a week:

On Monday	4	problems	correct	out	of 5.
On Tuesday	9	"	"	"	" 10.
On Wednesday ..	7	"	"	"	" 8.
On Thursday ...	12	"	"	"	" 12.
On Friday	15	"	"	"	" 20.

(b) What part of each day's lesson was correct?

(c) Find his grade for each day as a per cent.

(d) On squared paper make a line graph of the week's record.
(e) On which day was his work the best?
(f) On which was it the poorest?
(g) List the days in the order of his grades.
(h) In this way make a record of your work in arithmetic for a week.

3. (a) How many pupils are in your class?
(b) How many of them are boys?
(c) How many are girls?
(d) What part of your class is boys? What per cent of it is boys?
(e) What part of it is girls? what per cent?
(f) How many boys and how many girls are absent to-day?
(g) What is the per cent of attendance of the boys? of the girls? of the class?
(h) Keep the attendance of the boys and girls for a week.
(i) On squared paper make a graph of the two records together. To keep the two lines distinct make one in black ink and the other in red; or make one a continuous line and the other a dotted line.

4. (a) How many basketball games has your team played this year?
(b) How many have they won?
(c) What per cent of the games have they won?

5. (a) What is the estimated population of your city at present?
(b) What was its population at the last census?
(c) What is the increase since the last census?
(d) What is the per cent of increase over the population at the last census?

6. (a) The part of the financial report of a city school system for a year, with figures given in round numbers, is as follows:

Tuition Fund, $1,000,000	
Salaries of elementary principals and teachers	$ 600,000
Salaries of junior high school principals and teachers	175,000
Salaries of high school principals and teachers	225,000
Administration	
Salaries of superintendents and supervisors	20,000
Salaries of officers and janitors	130,000
Building Fund	
Permanent improvements and sites	75,000
Sinking Fund	110,000
Operating and other expenses	145,000
	$1,480,000

(b) What per cent of the total was spent on tuition? on administration? on sinking fund? (Find out what is meant by a sinking fund.) On permanent improvements? on operating expenses?

(c) What per cent of the tuition fund was spent on elementary schools? on intermediate or junior high schools? on senior high schools?

(d) The enrollment was as follows:

Elementary pupils	19,380
Intermediate pupils	4,950
High school pupils	3,150

Find the cost of tuition for each pupil in the elementary school; in the intermediate school; in the high school.

7. From a school report of your own city, find the various per cents of expenditures and cost for each pupil in each kind of school, and compare with the foregoing.

G. RAPID CALCULATION IN FRACTIONS AND PER CENTS

A few common fractions and their corresponding per cents are used in business more than others.

Fill in the blanks in the following table to show these fractions in their different forms:

	Common Fraction	Decimal Fraction	Cents in Part of a Dollar	Per cent
1	$\frac{1}{2}$	.5	\$ 50	50%
2	—	—	.20	—
3	—	.25	—	—
4	—	—	—	30%
5	$\frac{3}{5}$	—	—	—
6	—	—	.12$\frac{1}{2}$	—
7	$\frac{1}{3}$	—	—	—
8	—	.4	—	—
9	—	—	—	37$\frac{1}{2}$%
10	—	—	.70	—
11	$\frac{1}{6}$	—	—	—
12	—	.08$\frac{1}{3}$	—	—
13	—	—	—	66$\frac{2}{3}$%
14	—	—	.87$\frac{1}{2}$	—
15	$\frac{1}{16}$	—	—	—
16	—	.8	—	—
17	—	—	—	100%
18	—	—	.75	—
19	$\frac{5}{8}$	—	—	—
20	—	.83$\frac{1}{3}$	—	—
21	$\frac{5}{16}$	—	—	—
22	—	—	.01	—
23	—	—	—	10%

These fractions and their equivalent per cents should be learned as thoroughly as the multiplication tables, for they are used almost as much. Practice on these daily.

H. EVERYDAY USES OF PER CENTS

I. In Attendance

1. (a) If one-fifth of your class is absent, what per cent is absent? What per cent is present?

(b) If your class enrolls 40 pupils, how many are absent? How many are present?

(c) Solution:

$$20\,\% \text{ of } 40 \text{ pupils} = \tfrac{1}{5} \text{ of } 40 \text{ pupils}$$
$$= 8 \text{ pupils absent}$$

or

$$20\,\% \text{ of } 40 \text{ pupils} = .20 \text{ or } .2 \text{ of } 40 \text{ pupils}$$
$$= 8 \text{ pupils absent}$$

(d) Explanation:

In finding any per cent of a number, either its decimal or common fraction equivalent may be used. Sometimes one is more convenient than the other. Be sure to use the more convenient form.

(e) How many fifths of your class equals the whole enrollment?

(f) What per cent of your class equals the enrollment?

(g) Give three ways in which to find the number of pupils present.

(h) Is it correct to say $\frac{5}{5}$ = the enrollment? The problem states the enrollment = 40. The fraction $\frac{5}{5} = 1$. Can 1 equal 40?

(i) Is it correct to say let $100\,\%$ = the enrollment? $100\,\% = \frac{100}{100} = 1.00 = 1$. Can $100\,\% = 40$?

(j) Is it correct to write the statement as follows:

$100\,\%$ of the enrollment = 40?

Always be careful that every statement in your problem tells the truth.

2. A school has four large registration rooms. Their enrollments and per cents of attendance are as follows:

Room	Enrollment	Per cent of Attendance	No. Present	No. Absent
1	112	$87\frac{1}{2}\%$	....	....
2	127	93%	....	....
3	153	90%	....	....
4	118	95%	....	....
Total				

(a) Find the number present and the number absent in each room.

(b) Find the total enrollment, the total number present, and the total number absent in the school.

(c) Find the per cent of attendance for the school.

(d) What per cent of the school was absent?

II. In Budgets

1. (a) All good business men and thrifty housekeepers not only keep a strict account of all the money received and spent, but they plan for a month or a year ahead just how much they can afford to spend for the various items of expense. Such a plan is called a *budget.*

(b) If a school boy is allowed \$1.50 a week, and he plans that he must spend 75¢ for lunches, 15¢ for pencils, pens, and paper, 25¢ for car fare, and finds he can use 20¢ for recreation and save 15¢, he is making a personal weekly budget.

(c) Why is it wise for everyone to make a budget?

2. (a) The following table shows the budgets for three families. Find the amount spent for each item of expense by each family.

Items	Mr. White	$900 a year	Mr. Black	$1800 a year	Mr. Brown	$2400 a year
	Per cent of Income in Budget	Amount Spent	Per cent of Income in Budget	Amount Spent	Per cent of Income in Budget	Amount Spent
Food	40%	.....	35%	.....	25%	.....
Rent and Car Fare	20%	.....	20%	.....	20%	.....
Clothing	18%	.....	$16\frac{2}{3}\%$	.....	18%	.....
Housekeeping	7%	.....	8%	.....	12%	.....
Recreation, Gifts, Charity	8%	.....	$8\frac{1}{3}\%$	.....	10%	.....
Savings and Emergencies	7%	.....	12%	.....	15%	.....

(b) Which family spends the largest per cent of its income on food? Which spends the largest amount on food?

(c) State the item under which each of the following expenses belong:

Coal	Rug	Ice
Books	Gas bill	Towels
Concert	Telephone	Church dues
Doctor's bill	Shoes	Insurance

3. (a) Mrs. Green keeps an itemized memorandum of money she spends. Instead of listing the items in one column, she lists them in the six classes of expense.

(b) Classify the items listed in the following memorandum:

Expenses for Week of Nov. 17, 1918				Income $40.00 a week			
Nov. 17	Church, Sunday School		35	Nov. 21	Groceries		97
18	Groceries		85		Milk tickets	1	12
	Meat		42		Sharpening scissors		40
	Car tickets		25	22	Groceries		58
19	Plumber-thawing pipes	1	75		Meat		32
	Groceries		60		Picture show		50
	Shoes repaired		95		Car tickets		25
	Gas	3	10	23	Groceries	1	16
	Laundry	1	50		Meat		89
20	Groceries	1	18		Newspaper		52
	Meat		39		Silk for waist	3	50
	Pin — birthday gift	1	25		Waist pattern		15
	Thread		10		Thread		20
	Stamps		25		Buttons		50
	Asbestos pad for table		35				
	Ink		15		Balance	7	00
	Insurance	8	50				

(c) How much money was spent for food and housekeeping together?

(d) What per cent of the weekly income was spent for food and housekeeping together?

(e) Why was no rent included in this week's expenses?

(f) How much and what per cent was spent on clothing?

(g) What per cent of the income was saved?

4. These six groups are not the only ones in which household expenses may be classified. Show how expenses may be classified in another way.

5. (a) Prepare a memorandum of a week's expenses for a family whose income is $25 a week. If possible get the actual expenses of a family.

(b) Classify the expenses according to some good plan.

(c) Find what per cent of the weekly income is spent for the two most important items.

(d) Find what per cent is saved.

III. Buying and Selling

1. (a) A man bought a house for \$3200. He put \$400 in improvements. What was the total cost?
(b) He sold it at a gain of $16\frac{2}{3}\%$ of the cost.
(c) How much did he gain?
(d) How much did he sell it for?

2. (a) A man bought an automobile for \$1250. In order to buy a larger one, he later sold this one for \$1000. How much reduction did he make?
(b) What per cent of the cost was this reduction?

3. (a) A boy buys newspapers at $1\frac{1}{4}¢$ each. He sells them at $2¢$ each. What per cent of the cost does he gain?
(b) What per cent of the selling price does the newspaper publisher receive?
(c) What per cent of the selling price does the newsboy receive?
(d) If the boy sells \$2.56 worth of papers, how much does he gain?

4. A man built a house that cost \$3750. The lot cost \$750. He sold it at a gain of 20%. What was the selling price?

5. (a) A merchant failed in business. He was able to pay only 65% of his indebtedness. He owed \$5250 to Mr. Allen. How much did Mr. Allen receive?
(b) Find how much each of the following creditors received on the debts due.

Mr. Ames	\$4370.00
Mr. Barnes	564.00
Mr. Coons	196.75
Mr. Downy	314.50
Mr. Emery	65.00

6. (a) A merchant paid \$110.80 for vegetables and fruits during the month of July. So many of them spoiled that he received from his sales only 75 % of the cost. How much did he receive?

(b) How much did he lose on the fruit?

7. A merchant paid \$525.50 for sugar and gained $7\frac{1}{2}$ %. What was the selling price?

8. (a) A merchant paid \$2750 for 500 pairs of shoes. He sold 75 % of them at a gain of 50 %. Near the end of the season he decided to sell the rest (odd sizes) at a loss of 20 %. Did he gain or lose on the whole transaction?

(b) What was the selling price of the shoes in the reduction sale?

9. The following special prices were offered for Christmas. Estimate the per cent saved. Find the exact per cent saved.

Material	Regular Price	Sale Price	Per cent Saved
36 in. Fancy Silks	\$2.00 a yd.	\$1.59	....
36 in. Fancy Silks	2.50 " "	1.98	....
36 in. Fancy Silks	3.00 " "	2.48	....
40 in. Foulards	2.50 " "	1.95	....
40 in. Crêpe de Chine	1.50 " "	1.29	....
40 in. Crêpe de Chine	2.00 " "	1.75	....
40 in. Crêpe de Chine	2.50 " "	2.00	....

10. (a) During the war prices of food, clothing, and other commodities were greatly increased. Find the amount and the per cent that each of the articles listed below was increased.

(b) Even in peace times, prices change greatly from year to year. Compare the present prices with those of 1919, and find the per cent of increase or decrease of each.

	Article	Cost in 1913	Cost in 1919	Amount of Increase	Per cent of Increase
1	Bread.....	.10 a lb. loaf	.15 a lb. loaf	..	..
2	Butter.....	.35 a lb.	.75 a lb.	..	..
3	Eggs.....	.36 a doz.	.78 a doz.	..	..
4	Ham.....	.30 a lb.	.60 a lb.	..	..
5	Lard.....	.12 a lb.	.36 a lb.	..	..
6	Potatoes....	1.00 a bu.	2.40 a bu.	..	..
7	Sugar.....	.06¼ a lb.	.11 a lb.	..	..
8	Pork.....	.18 a lb.	.40 a lb.	..	..
9	Flour.....	1.00 a ⅛ bbl. sack	1.80 a ⅛ bbl. sack	..	..
10	Milk.....	.08 a qt.	.15 a qt.	..	..
11	Coal.....	3.25 a T.	6.50 a T.	..	..
12	Shoes.....	8.00 a pair	12.00 a pair	..	..
13	Jersey cloth..	4.00 a yd.	6.50 a yd.	..	..
14	Silk.....	1.50 a yd.	2.50 a yd.	..	..
15	Serge.....	1.25 a yd.	2.25 a yd.	..	..
16	Silk gloves ..	1.00 a pair	1.75 a pair	..	..

I. THE COST OF DOING BUSINESS

I. Figured on Sales

1. (a) If a leather goods merchant bought 50 suit cases from the manufacturer for $265 and it cost him $10 to have them hauled from the depot to his store, he would, of course, have to count his cost as $275. If he sold them immediately, without any further expense, at a gain of 20%, for how much each would he sell them?

(b) But suppose he does not sell them immediately and some lie on his shelves for one, two, or more months. The merchant is having to pay rent for his store during this time. He has to pay for light and heat, for clerks, for insurance against loss by fire, and for many other items. All of these expenses should be added to the cost of the suit cases, before he can count his gain.

(c) Will these additional expenses be the same if it takes two months to sell the suit cases as if they were sold in two weeks?

(d) The original cost is a fixed amount. But the selling expense varies. The gross cost cannot be known exactly until the goods are sold. Therefore, many merchants fix the selling price high enough to cover the probable selling expenses and a profit. Since the selling price is a fixed amount and the cost is not, it is customary for most business houses to calculate their per cents of profit and expenses on the selling price instead of the cost. After a little experience in business one can make a very good estimate of the selling expenses, or the *cost of doing business.*

(e) Should a salary for the owner of a store be included in the cost of doing business? If he were not working for himself, some other man would pay him a salary.

(f) In figuring the expenses of raising a crop of corn or wheat, should a farmer include in the cost wages for himself and the keep of his horses?

(g) In a factory, a machine must be replaced every ten years. What part of its cost should be charged each year to the cost of doing business? Such an allowance made for the wearing out of machinery, building, or equipment of any kind is called *depreciation.*

(h) If a house is built well enough to last fifty years, what per cent of its cost should be charged in its annual expenses as depreciation? Which part of a piece of real estate usually increases in value instead of decreases? Land values usually *appreciate,* but buildings *depreciate.*

2. (a) The life of an airplane is said to be 100 flying hours. What is meant by such a statement?

(b) In figuring the cost of flying a machine for one hour, what per cent of its cost should be charged to depreciation?

3. An automobile that is used constantly may give service for five years before it is junked. What per cent of its cost must be included as depreciation in the annual expenses of running the car?

4. The life of an automobile depends upon the amount and kind of use, and upon the quality of its construction. Which is the better investment, a $2400 truck that will last eight years or a $2000 truck that will last five years?

5. Depreciation in dry goods is estimated at 1.4% of the sales. What is the depreciation in a store whose annual sales are $25,000?

6. Depreciation in the grocery business is about .6% of the sales. How much would it amount to if the sales were $15,500?

7. What is the depreciation in the furniture business at 1.9% on sales of $42,450?

8. (a) Advertising is another selling expense included in the cost of doing business. This ranges from about .7% to 3.5% of the sales.

(b) In which kind of business would it be the highest, dry goods, grocery, or furniture?

9. (a) If a dry goods merchant spends 1.5% of his sales on advertising, how much does he spend on a $28,500 business?

(b) How much, if his sales are $16,750?

10. If a furniture dealer spends 2.9% of his sales on advertising, how much does he spend if his sales are $54,000? If his sales are $275,000?

11. (a) The first cost of an automobile was $2000.

The expenses for the first year were as follows:

State license	$ 5
Tax	25
Garage and cleaning	240
Tires, 3 tires for each of the wheels at $45	..
Repairs	200
Oil, 24 gal. at 90¢ a gallon	...
Gasoline, 1000 gal. at 25¢ a gallon	...
Allow 25 % for depreciation.	...

If the car ran 12,000 miles during the year, what was the cost a mile?

(b) Would the per cent of depreciation be as great the second year as the first? Why?

12. (a) By comparing the total expenses of a large number of stores of the same kind, an average cost of doing business may be found. If this average for a dry goods store is 23.1 %, what is the cost of doing business in a store whose sales are $75,000?

(b) If the merchant makes a profit of 20 %, how much does he make?

(c) What per cent of the sales was the first cost of the goods?

(d) How much was the first cost?

13. (a) In the grocery business, the average cost of doing business is 16.4 % of the sales. What does this cost amount to, if the sales are $33,000?

(b) What do the profits amount to if they are 25 % of the sales?

(c) What per cent of the sales is the first cost?

(d) What is the amount of the first cost?

14. (a) The average cost of running the furniture business is 25.4 % of the sales. Explain this increase over the dry goods business, by giving

two or more items of expense that would be greater.

(b) Find the operating expenses on sales amounting to $85,960.

(c) Find the profits if they are 12%.

(d) What is the first cost of the furniture?

15. (a) Make five or more problems like the foregoing about the cost of doing business.

(b) Solve either your own or those of a classmate.

J. RAPID CALCULATIONS

Use pencils only when necessary.

1. Find the cost of

(a) $1\frac{1}{2}$ doz. eggs at $.56 a dozen.

(b) 3 yd. of lace at $12\frac{1}{2}$ cents a yard.

(c) $\frac{2}{3}$ yd. of braid at 25 cents a yard.

(d) $\frac{1}{2}$ doz. buttons at 75 cents a dozen.

(e) 1 lb. 2 oz. of steak at $.35 a pound.

(f) 2 pecks of potatoes at $1.25 a bushel.

(g) 1 lb. 5 oz. of butter at $.60 a pound.

(h) 1 doz. lemons at 2 for 5¢.

(i) 4 buttons at $.50 a dozen.

(j) $\frac{1}{2}$ doz. cakes at $.15 a dozen.

(k) $1\frac{1}{3}$ yd. of cloth at $.89 a yard.

(l) 3 grapefruit at 2 for $.15.

(m) $\frac{3}{4}$ yd. of net at $.30 a yard.

(n) $\frac{3}{8}$ yd. silk at $2 a yard.

(o) 3 lb. apples at $.06$\frac{1}{2}$ a pound.

(p) 3 oranges at $.40 a dozen.

(q) 1 qt. milk at \$.50 a gallon.

(r) 60 newspapers at \$.01$\frac{1}{4}$ each.

(s) 4 yd. lace at \$.12$\frac{1}{2}$ a yard.

(t) 5 lb. sugar at \$.09$\frac{1}{2}$ a pound.

(u) 1$\frac{3}{4}$ lb. meat at \$.28 a pound.

2. Find the gain on 60 papers at $\frac{3}{4}$¢ each.

3. How many inches in $\frac{1}{3}$ yd.? $\frac{1}{8}$ yd.? $\frac{1}{2}$ yd.? $\frac{5}{8}$ yd.? $\frac{2}{3}$ yd.? $\frac{7}{8}$ yd.? $\frac{3}{4}$ yd.? 1$\frac{1}{8}$ yd.? $\frac{1}{4}$ yd.? $\frac{5}{16}$ yd.?

4. What is the width in yards of material 54 inches wide? 48 inches? 27 inches? 30 inches? 45 inches? 24 inches?

5. How wide is 9-quarter sheeting?

6. How many quart baskets of berries in a crate containing 1 bushel?

7. What part of a bushel is 24 quarts?

8. How much is

(a) $\frac{1}{2}$ of 650; of \$4.50; of 37$\frac{1}{2}$ cents; of \$3.25?

(b) 50 % of 750; of \$5.40; of 62$\frac{1}{2}$ cents; of \$4.75?

(c) $\frac{1}{3}$ of 750; of \$3.75; of 50 cents; of \$1.75?

(d) 12$\frac{1}{2}$ % of 400; of 800; of 30 cents; of \$1.80?

(e) $\frac{1}{4}$ of 500; of 600; of 75 cents; of \$2.50?

(f) 2 % of 1000; of \$9.50; of 87$\frac{1}{2}$ cents; of \$6.25?

(g) 5 % of 900; of \$3.50; of 90 cents; of \$4.98?

(h) $\frac{1}{6}$ of 840; of \$5.80; of 50 cents; of \$4.50?

(i) 6 % of 1200; of \$2.50; of 98 cents; of \$7.20?

(j) 16$\frac{2}{3}$ % of 120; of \$6.40; of 37$\frac{1}{2}$ cents; of \$5.60?

(k) $\frac{1}{12}$ of 130; of \$7.20; of 62$\frac{1}{2}$ cents; of \$3.50?

(l) 12 % of 500; of \$6.10; of 12$\frac{1}{2}$ cents; of \$4.90?

(m) $\frac{1}{5}$ of \$2.80; of 490; of 49 cents; of \$5.84?

(n) 37$\frac{1}{2}$ % of \$2.50; of 320; of 50 cents; of \$6.50?

(o) 20 % of \$18; of 355; of 78 cents; of \$1.75?

(p) 1 % of \$1.25; of 898; of $37\frac{1}{2}$ cents; of \$1.80?

(q) 10 % of \$5.25; of 430; of 75 cents; of \$1.89?

9. A load of coal weighs 3250 pounds. Find the cost of the coal at \$5.60 a ton.

10. A man bought his supply of coal for the winter. It was delivered in three loads, weighing respectively 5680, 5365, and 5955 pounds. Find the number of tons of coal he bought. How much did it cost at \$5.35 a ton?

K. SPECIAL SALES

I. Discounts

1. (a) Sometimes, especially in dull seasons, as January and July, merchants sell goods at reduced prices. Why?

(b) Give other reasons for special sales.

(c) Such reductions from the marked prices are spoken of as *discounts*. *Dis* is a Latin prefix meaning *away from* or *off*. Any amount *counted off* from the price is a *discount*.

2. A chair was marked to sell at \$12. The merchant, wishing to attract customers to his store by offering a special bargain, advertised the chair at \$9. How much was the discount? What was the per cent of discount?

3. (a) At a January sale, a merchant advertised the following discounts:

$33\frac{1}{3}$ %	discount	on	all	winter coats and suits.
20 %	"	"	"	boys' overcoats and suits.
$16\frac{2}{3}$ %	"	"	"	draperies and curtains.
15 %	"	"	"	shoes.
10 %	"	"	"	table linen, handkerchiefs, bedding, and towels.
25 %	"	"	"	leather goods.
$12\frac{1}{2}$ %	"	"	"	silk and woolen goods.

(b) What is the sale price for each of the following articles?

	Article	Marked Price	Per cent of Discount	Sale Price
1	Lace Curtains	$5.40 a pair		
2	Silk	1.50, 2.00, 2.25 a yd.		
3	Suit	45.00		
4	Shoes	7.50		
5	Coat	48.75		
6	Serge	1.60, 2.00, 2.40 a yd.		
7	Leather bag	5.00		
8	Boy's suit	8.75		
9	Drapery	2.50 a yd.		
10	Sheets	1.80 each		
11	Pillow cases	1.25 a pair		
12	Boy's overcoat	12.50		
13	Tablecloth	5.25		
14	Napkins	4.50 a doz.		
15	Suit	37.50		
16	Towels	.37½		
17	Handkerchiefs	.25, .50, .60		
18	Purse	3.50		
19	Comfort	9.50		
20	Broadcloth	4.25		

(c) Explain why a larger discount is given on certain articles than on others.

(d) A discount should never contain more than the two decimal places for cents.

(e) Always omit unnecessary figures, and calculate mentally to see whether the fraction of a cent should be dropped, or an extra cent or more should be added. When possible use short cuts.

4. Illustrations of Discount

(a) The marked price of a piano with a bench is $435.75. If 5% discount is given, what is the net price, that is, the selling price after the discount is taken out?

Process		*Explanation*
$435.75	Marked price	To find 5% of $435.75, find $\frac{1}{20}$ of it. $20 = 10 \times 2$, therefore divide first by 10 by thinking the change of the decimal point. Then divide by 2. Why is the last digit of the discount 9 instead of 8?
21.79	5% discount	
$413.96	Net price	

(b) A bill of $326.85 is discounted 2% if paid in cash. Find the net amount.

Process		*Explanation*
$326.85	Gross amount	Find out what gross amount means. If $326.85 were multiplied by .02, how many decimal places would be in the product? How many should be in the discount? Just think of $.85 \times 2$, or 1.70, as nearer 2 than 1, so 2 must be carried. Begin multiplying 6 by 2 and add the 2 carried, and place the 4 under the cents' column.
6.54	2% discount	
$320.31	Net amount of bill	

5. What are the fractional equivalents of the following per cents?

(a)	10%	5%	$2\frac{1}{2}$%	$1\frac{1}{4}$%
(b)	50%	25%	$12\frac{1}{2}$%	$6\frac{1}{4}$%
(c)	$66\frac{2}{3}$%	$33\frac{1}{3}$%	$6\frac{2}{3}$%	$3\frac{1}{3}$%

6. Find the net amounts of the following bills in the shortest possible way. Omit all unnecessary figures.

(a)	$398.75	less	5%	discount
(b)	263.80	"	4%	"
(c)	175.50	"	3%	"
(d)	424.80	"	$1\frac{1}{4}$%	"
(e)	362.80	"	$2\frac{1}{2}$%	"
(f)	125.40	"	2%	"
(g)	79.60	"	1%	"
(h)	960.00	"	$3\frac{1}{3}$%	"

7. (a) The following advertisement tells of some special Christmas offers on pianos.

CUT PRICES ON PIANOS

Here is your inducement to buy now.

$295 PIANO for $270
$325 PIANO for $295
$375 PIANO for $345
$425 PIANO for $385
$475 PIANO for $425

(b) Find the amount each piano was reduced in price.

8. When one sees offers of special reductions in advertisements or in stores, one does not wish to figure out with pencil the exact per cent of reduction. Instead, one should learn to make quick mental estimates that are nearly correct. In such estimates, in place of the exact numbers use the nearest "round number." For example, \$300 is \$295 in round numbers. A \$25 reduction on \$295 is not far from a reduction of \$25 on \$300; that is, $\frac{25}{300} = \frac{1}{12}$ or $8\frac{1}{3}\%$.

The correct per cent of reduction is $\frac{25}{295}$ or over 8.4%.

$$
\begin{array}{r}
.084+ = 8.4+\% \\
295\overline{)25.00} \\
23\ 60 \\
\hline
1\ 400 \\
1\ 180 \\
\hline
220
\end{array}
$$

9. Fill in the following blanks.

Make all estimates before finding exact per cents.

	Marked Price	Sale Price	Amount of Reduction	Estimated Per Cent of Reduction	Exact Per Cent of Reduction
(a)	$295	$270	$25	8⅓%	8.4%
(b)	325	295	...	....	.....
(c)	375	345	...	....	.....
(d)	425	385	...	....	.....
(e)	475	425	...	....	.....

(f) On which was the largest amount of reduction made? the smallest?

(g) On which was the largest per cent of reduction given?

10. (a) The following is part of an advertisement of a special sale. Estimate the per cent of reduction in price.

(b) Find the exact per cent of discount on each article.

THE STOCK REDUCTION SALE
IN THE CURTAIN AND DRAPERY DEPT.

Offers wonderful savings on all drapery purchases

RANGING FROM 20% TO 40%

Note the following:

40¢ Marquisettes, white, cream, or ecru, yard .....29¢
55¢ Marquisette, white, cream, or ecru, yard .....42½¢
25¢ Silkoline, plain and figured, yard.....20¢
35¢ Silkoline, wide range of colors, yard.....28¢
75¢ White Grenadine, 36 inches wide, yard.....50¢
$1.50 Silk Finished Drapery, for overhanging.....$1.00
$1.25 Colored Madras, for overhanging, yard.....89¢
75¢ Cretonnes, wide range of colors.....60¢
$1.00 Cretonnes, in colors and patterns for all needs.....80¢
$1.25 Cretonnes, several in double prints, yard.....$1.00
$1.50 Cretonnes, all high-class patterns, yard.....$1.20
$1.75 Cretonnes, in single and double prints, yard.....$1.40

(c) Which one had the largest per cent of discount?

(d) Which one had the smallest?

11. (a) Below is an advertisement taken from a newspaper.

(b) Find the net prices on wardrobe trunks at \$50, \$65, and \$75.

(c) On fitted traveling bags marked \$10, \$12.50, \$18, \$25, and \$27.50.

(d) On collar bags valued at \$2, \$3.50, and \$4.25.

(e) On steamer trunks marked \$15.50, \$22.50, \$24, and \$27.50.

(f) On English kit bags valued at \$25, \$27.50, \$33, \$42.50, \$55, and \$68.

(g) On portfolios marked \$2, \$4.50, and \$5 up to \$17.50.

(h) On purses at prices ranging from \$1.50 to \$25.

12. Find an advertisement in a local paper, offering special reductions on at least five different items. Make and solve ten problems based on this advertisement.

13. (a) Write an advertisement for a special sale in a drug store or dry goods store. Offer discounts on at least ten articles.

(b) Find the amount saved on each article advertised.

L. WHOLESALE AND RETAIL PRICES

1. (a) Publishers of books send out catalogues to booksellers and schools with names and prices of the books listed. The prices in a catalogue are called *list prices*. Publishers usually give a discount to schools and book dealers who buy books in wholesale quantities.

(b) In some states, the law fixes the discount given by the publishers and the per cent of gain that the dealer may charge on school books. In Ohio the publisher must give a discount of 25% on the list price, and the dealer may add a profit of 10% of the cost to fix his retail price. For example, a history listed by the publisher at \$1 is sold to the dealer at 25% off, or at 75¢. The dealer's profit is 10% of 75¢ or 8¢. The selling price to school children is 75¢ + 8¢ or 83¢.

2. From the following price lists of school books, find the cost of each to the book dealers of Ohio and to the school children of the state.

Text	List Price	Wholesale Price in Ohio	Retail Price in Ohio
First Reader	$ .30		
Sixth Reader	.50		
Arithmetic	.40		
Geography	1.10		
U. S. History	1.00		
Physiology	.60		
Speller	.22		
English	.65		
Bookkeeping	1.50		
Blank books	.60		
Short Stories	1.10		
Treasure Island	.25		
Latin	1.10		
French	.64		
Spanish	1.20		
Algebra	1.15		
Dictionary	.60		
American History	1.50		
History of Rome	.35		
English History	1.00		
Citizenship	.72		
General Science	1.20		
Biology	1.25		
Geography	1.30		
French Stories	.60		
Business Arithmetic	.65		
Manual Training	1.45		
Cooking	.52		

3. (a) Find out how school books are sold in your own state.

(b) From a catalogue find the list price of books used in your school.

(c) Calculate their wholesale and retail prices.

4. Two high school boys have a supply store in the school. They buy in large quantities the pens, pencils, paper, and other supplies the pupils need, and sell them in

small quantities; that is, they buy at wholesale and sell at retail. Their profits vary according to the per cents given in the table. Find the retail prices of the following articles.

Wholesale			Profit	Retail	
Article	Price	Amount	Per cent of Cost	Selling Price	Amount
Black ink (2 oz. bottle)	$ .60	a doz.	100	.....	a bottle
Red ink ($1\frac{1}{4}$ oz. bottle)	.45	" "	$33\frac{1}{3}$	.....	" "
Pencils	4.32	" gross	$66\frac{2}{3}$	.....	each
Drawing pencils	5.76	" "	25	.....	"
Theme tablets	.40	" doz.	50	.....	"
Pencil tablets	.40	" "	50	.....	"
Geometry tablets	1.80	" "	$33\frac{1}{3}$	.....	"
Protractors	2.40	" "	25	.....	"
Wooden rulers	1.44	" gross	100	.....	"
Erasers	.40	" doz.	50	.....	"
Drawing triangles	.96	" "	25	.....	"
Compass, No. 1	2.40	" "	25	.....	"
Compass, No. 2	.90	" "	$33\frac{1}{3}$	.....	"
Legal cap paper	1.00	" ream	150	.....	a sheet
Typewriter paper	.80	" "	$37\frac{1}{2}$	.....	a quire
Notebooks, Size A	.40	" doz.	50	.....	each
Notebooks, Size B	.45	" "	$33\frac{1}{3}$	.....	"
Loose leaf notebooks	2.25	" "	$33\frac{1}{3}$	.....	"
Paper for loose leaf books	.72	" pkg.	$66\frac{2}{3}$	.....	a pkg.
Pen points	.72	" gross	100	.....	a dozen
Art gum	.40	" doz.	50	.....	each

5. (a) During the war the Government fixed prices of foodstuffs that the retail grocer should pay to the wholesaler, and also the prices charged the consumer. From time to time these price lists were published in the papers. From the following list calculate the per cent of gain on each article.

(b) On which did the grocer make the largest profit? on which, the least?

PRICE LIST		PRICES TO PAY
Article	*Retailer Pays*	*Consumer Should Pay*
Flour		
Spring wheat	\$11.53 @ 11.85 a bbl.	\$1.60 @ 1.65, $\frac{1}{8}$ bbl. $6\frac{3}{4}$ @ 7¢ a lb.
Winter wheat	11.00 @ 11.75 a bbl.	\$1.57 @ 1.62, $\frac{1}{8}$ bbl. $6\frac{3}{4}$ @ 7¢ a lb.
Barley flour	9.40 @ 10.00 a bbl.	6 @ $6\frac{1}{2}$¢ a lb.
Corn meal (white or yellow)	4.00 @ 4.10$\frac{3}{4}$ a cwt.	$5\frac{1}{2}$ @ 6¢ a lb.
Corn flour	5.25 @ 5.75 a cwt.	6 @ $6\frac{1}{2}$¢ a lb.
Cornstarch	$7\frac{1}{2}$ @ $9\frac{1}{2}$¢ lb. pkg.	10 @ 13¢ a pkg.
Rice, bulk (Blue Rose or Japan style)	9.25 @ 9.90 a cwt.	12 @ 13¢ a lb.
Rice flour	8.60 @ 9.85 a cwt.	10 @ 13¢ a lb.
Rolled oats, bulk	$5\frac{1}{4}$ @ $5\frac{3}{4}$¢ a lb. sack	$6\frac{1}{2}$ @ 7¢ a lb.
Package	3.75 @ 3.95 a case (36 20-oz. pkgs.)	13 @ 15¢ a pkg. (20-oz. pkg.)
Eggs, fresh	70¢ a doz.	77 @ 78¢ a doz.
Eggs, storage	53¢ a doz.	60 @ 61¢ a doz.
Butter, creamery	71¢ a lb.	77 @ 78¢ a lb.
Sugar, granulated	9.70 a cwt.	11¢ a lb.
Beans, white	10.05 @ 10.80 a cwt.	$12\frac{1}{2}$ @ 14¢ a lb.
Beans, colored	6 @ 9¢ a lb.	8 @ 11¢ a lb.
Lard, pure	$28\frac{3}{4}$ @ $30\frac{1}{2}$¢ a lb.	35 @ 36¢ a lb.
Bread, 1-lb. loaf	$6\frac{1}{2}$ @ 8¢ a loaf	8 @ 10¢ a loaf
$1\frac{1}{2}$-lb. loaf	9 @ $12\frac{1}{2}$¢ a loaf	10 @ 15¢ a loaf (2 for 29¢)
Cheese, full cream	36 @ $39\frac{3}{4}$¢ a lb.	43 @ 47¢ a lb.

(c) By a line or bar graph, compare the profit made on wheat flour, barley flour, corn meal, corn flour, cornstarch, rice, and rice flour.

M. DOING BUSINESS FOR OTHERS

I. Commission

1. (a) If a person builds a house, he usually gets an architect to draw plans for it and to superintend the building of it. The architect's charges will vary with the cost of the house, for he gets a certain per cent of the cost.

(b) If a real estate dealer sells a piece of property

for someone, he charges a per cent of the selling price.

(c) If the amount paid to one person for doing business for another changes or varies with the amount of business done, it is called a *commission*.

(d) A shoe manufacturer may sell his goods by sending out traveling salesmen who visit and sell to the shoe dealers. These salesmen may be paid a fixed salary, or they may be paid a per cent of the amount of goods sold.

(e) Which method of payment would be the better incentive to the salesman to do the most business?

(f) With which method does the salesman run the greater risk?

(g) Sometimes a salesman receives a fixed salary and also a per cent of all goods sold above a certain amount.

(h) Compare the last method with the other two, from the point of view of the salesman and of the manufacturer.

2. A real estate agent sells a house for $5600. If he charges the owner 3% commission, how much does he receive?

3. Another agent offered to sell it, charging 5% commission for the first $2500, and 2% on all above $2500. Which agent was the cheaper and how much?

4. (a) A school, giving an entertainment, asked the pupils to sell tickets. Each pupil who sold ten tickets for the school was given one for himself. What was the rate of the pupil's commission?

(b) If the school sold five hundred tickets at twenty-five cents each, and on four hundred of them the free ticket was given for every ten, what were the school receipts?

(c) What was the amount of commission given in tickets?

5. If an architect plans a house costing $4800 and charges 5% commission, how much does he receive?

II. Graphs of Commission

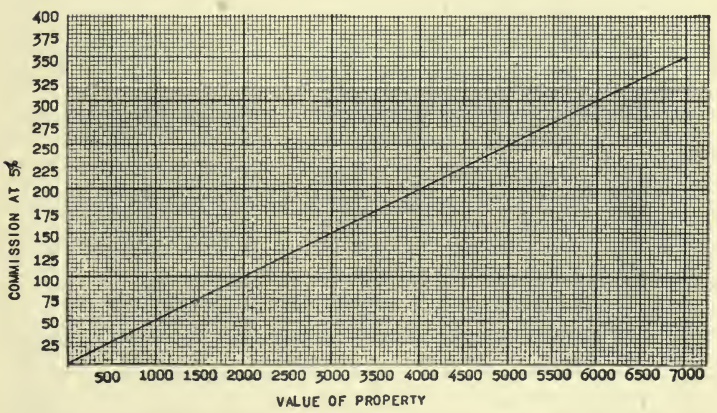
1. (a) On squared paper, we can draw a line to show just how his commission changes or varies with the value of the house.

(b) On the horizontal line, let each five squares represent $250 of value in the property; and on the vertical line, let each five squares be $25 commission.

5% on $500 = $25. Opposite $25 and above $500 place a dot.

5% on $1000 = $50. Opposite $50 and above $1000 place a dot.

5% on $2000 = $100. Opposite $100 and above $2000 place a dot.



(c) In like manner, locate several other dots.

(1) What kind of line can be drawn through all of the dots?

(2) Very carefully draw a straight line through all of them. This is a graph of 5% commission.

(d) From the graph, one can read at a glance the correct commission for the different values of houses.

(e) To find the commission on a $2500 house, follow the vertical line from $2500 until you reach the graph. From that point follow the horizontal line over to the amount of commission at the left.

(f) Read the commissions on $1500, $3500, $4000, $5500, $7000, $6500, $4500.

(g) Which line between $4500 and $5000 stands for $4800?

Follow that line to the graph and across to the commission line.

How many spaces above the $225 mark is this new point?

(h) How many dollars does each space on the commission line stand for?

(i) Count up from $225 to this point and give the amount of commission on $4800.

(j) Compare this with your calculation.

(k) Read the commissions on houses valued at $1800, $2400, $3600, $5200, $6400, $6800, $4200.

(l) Find the $2250 value line and trace it.

Is it on a line or halfway between two lines?

Note that the tracing comes out halfway between $100 and $125 commission, or $112.50.

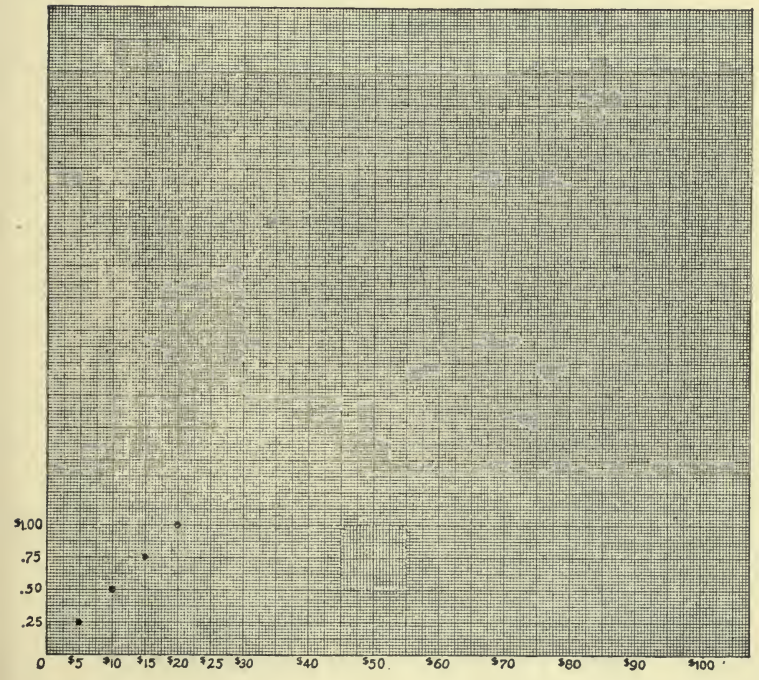
(m) Read the commissions on houses valued at $3250, $4250, $3750, $5250, $6750, $6250, $4750, $1750.

2. (a) Make another graph showing 5% on amounts from \$7000 to \$14,000.

(b) From it read commissions on the following amounts:

\$ 8,500	\$13,500	\$12,500	\$8,250
11,000	12,250	8,000	13,000
7,250	11,750	7,500	10,250
12,750	9,500	\$10,500	9,750
9,000	12,000	11,250	9,250
14,000	10,000	7,750	11,500

3. Complete the following graph showing 5% on amounts from 0 to \$100.



4. From this graph read the value of 5 % of:

$35.00	$88.00	$97.50	$37.50
58.00	94.00	32.50	49.50
79.00	73.00	58.50	12.25
62.00	16.50	85.50	55.25
47.00	23.50	64.50	18.75

5. (a) From the two graphs given in problems 1 and 3, you can read the value of 5 % of larger numbers that have both dollars and cents.

(b) Illustration:

What is 5 % of $2785.50?

$2785.50 = $2750.00 + $35.50

5 % of $2750.00 = $137.50 (First graph)

5 % of 35.50 = 1.78 (Second graph)

5 % of $2785.50 = $139.28

(c) Instead of separating $2785.50 as above, it may be separated into $2700 + $85.50.

(d) Find the value by using these parts.

6. With the two graphs find the value of 5 % of:

$2447.50	$1662.50	$6893.50	$ 807.50
3572.50	5854.50	1258.50	2523.50
975.50	4537.50	2606.50	2787.50

N. LENDING MONEY

I. Interest

1. (a) You have found that it is a great convenience to the people of a community to have a safe bank in which they may keep their money, and that it is also a great convenience to be able to pay bills by check. But how is the banker paid for providing this safe place, and for going to the trouble and expense of keeping the accounts? He does not charge the depositor anything for keeping his money safe. Some banks charge 50 cents a month if the account is less than $50.

(b) It takes a great deal of money to start a bank, so much that one man seldom has enough. Usually a bank is owned by a number of men who have shares in the business. The laws are very strict about how the banking business shall be run, in order to protect the depositors.

(c) From all the depositors a large sum of money accumulates in a bank, much more than is withdrawn for the ordinary daily business. The banker lends this extra money to reliable persons or firms, and for its use he receives a certain amount of money. This money received for the use of a larger sum of money is called *interest.*

(d) If one lives in a house belonging to another, he pays rent for its use. If one hires a horse or an automobile belonging to another, he pays rent for its use. If, instead of using another's house or another's automobile, both of which have cost the owner money, one uses his money itself, it is only right that he pay rent for its use. This rent paid for the use of money is called *interest.*

(e) By lending money the bank serves the business interests of a community. Many men could not keep going during certain times of the year if they could not borrow money from a bank; for there are seasons in business as in the weather. For example, coal dealers make money in the winter, but may need to borrow from the banks during the summer. For shoe dealers, spring and fall are the busy seasons. Merchants of different kinds borrow from the bank when they lay in their seasons' stocks. The farmer is without income during the winter. In the

spring and summer he borrows money to pay for harvesting and transporting his crops to market. If employers could not borrow money in dull seasons, workmen would be idle. So we find that the welfare of all persons in a community depends upon keeping all business going through both dull and busy seasons. Since the banks make this possible, banking is a business in which the public is interested.

2. (a) The rent one pays for a house or an automobile depends upon the time one uses it. So the rent or interest paid for the use of borrowed money depends upon the time one uses it.

(b) If you borrow \$100 and use it for a year, the banker may charge you \$6 rent for it, and at the end of the year you must return the \$100 to him, just as you turn over a rented house to the owner when you vacate it.

(c) If you pay \$6 interest for \$100 for a year, how much should you pay if you use \$200 for a year? \$300? \$400? \$250?

(d) If you pay \$6 interest for \$100 for a year, how much should you pay if you use it for 2 years? for 3 years? for 4 years? for $2\frac{1}{2}$ years?

(e) How much should you pay to use \$200 for 2 years?

(f) If you pay \$6 interest for \$100 for a year, what per cent of the amount borrowed do you pay?

3. The price paid for borrowed money is always quoted as a certain per cent of the amount borrowed. This per cent is the *rate of interest.* The amount of money borrowed or at use is the *principal.*

4. How much do you pay for using \$500 for a year at the rate of 4% interest?

5. Find the interest on \$750 for a year at the rate of 5%.

6. Find the interest on \$750 for 3 years at 5%.

7. Find the interest on \$750 for half a year at the rate of 5%.

8. What effect on the interest does a change in time have?

9. (a) What three numbers or factors are in every problem in interest?

(b) Label each of the numbers given in the last example.

(c) Illustration:

Given numbers	Problem
\$750 = Principal	To find the interest
$\frac{1}{2}$ yr. = Time	
5% = Rate of interest	

10. (a) How does the amount of interest change as the principal increases or decreases?

(b) How does the interest change as the rate of interest changes?

(c) How does the interest change as the time varies?

(d) If \$1000 is lent at 6% a year,

the interest for 1 year = 6% of \$1000
= .06 of \$1000
= \$60

Evidently the interest for 2 years = 2 × \$60
= \$120

Or, the interest for $\frac{1}{2}$ year = $\frac{1}{2}$ of \$60
= \$30

(e) What three numbers have been multiplied together to find the interest for 2 years?

To save time the three numbers may be multiplied together at one time.

Interest = \$1000 × .06 × 2
= \$120

Or, interest = $1000 \times \frac{6}{100} \times 2$
= \$120

(f) The rate of interest may be used in the common fraction or decimal form. Always choose the more convenient one.

11. (a) Find the interest on \$960 at $4\frac{1}{2}\%$ for 2 yr. 6 mo.

Given numbers	Problem
\$960 = Principal	To find the interest
$4\frac{1}{2}\% = \frac{9}{2}\% = \frac{9}{200}$ = Rate of interest	
2 yr. 6 mo. $= 2\frac{1}{2}$ yr. $= \frac{5}{2}$ yr. = Time	

Solution

$$\text{Interest} = \text{Principal} \times \text{Rate} \times \text{Time}$$

$$= \$\cancel{960}^{12} \times \frac{9}{\cancel{200}_{\cancel{40}}} \times \frac{\cancel{5}^{3}}{\cancel{2}_{1}}$$

$$= \$108$$

(b) To see how much shorter this solution is, compare it with the following:

\$960	Principal
$.04\frac{1}{2}$	Rate of interest
480	
3840	
\$43.20	Interest for 1 year
$2\frac{1}{2}$	
2160	
8640	
\$108.00	Interest for $2\frac{1}{2}$ years

12. James lends his brother \$5 for 3 years at 5%. How much interest does he receive?

13. Lewis is a senior in college. He finds he does not have time to work and study too. So he borrows \$350 from the student loan fund at 4% for $2\frac{1}{2}$ years. How much interest does he pay?

14. Mary put \$15 in the savings bank January first. How much interest will she get in 6 months at $4\frac{1}{2}\%$?

15. A teacher lent her uncle \$600 to put in his business. How much interest did she receive in 5 years at 6%?

16. A boy lent his father \$22 for $4\frac{1}{2}$ years at 6%. How much interest did he receive for it?

17. A boy borrows \$10 from his father to start himself in the business of selling papers. How much interest should he pay in 6 months at $5\frac{1}{2}$%?

18. A merchant borrows \$5000 to start in business. How much interest will he pay in 6 years at 6%?

19. A man buys a house for \$6500. He pays \$4000 in cash, and gives the original owner a mortgage for the balance of \$2500. On the mortgage he pays 6% interest for 5 years, when he pays off the mortgage.

(a) How much more than \$6500 did the house really cost?

(b) Find out what a mortgage is.

(c) Do most property owners carry mortgages on their property or not? What is the advantage of doing it? Is there any disadvantage?

20. (a) A man invests \$10,000 in a grocery. At the end of a year he has made \$2000 by turning his stock over three times. If he had put it in the bank at $4\frac{1}{2}$%, how much interest would he have received?

(b) Which is the better investment?

(c) How much better?

21. A girl lends her sister \$50 at 5% interest. How much interest will she receive in 5 years? in 6 years? in $6\frac{1}{2}$ years? in 10 years?

22. A girl borrows \$75 from her brother. How much interest will she pay him in 4 years at 6%? in 8 years? in $9\frac{1}{2}$ years?

23. (a) A boy in college borrows \$150 from his sister who is working. How much interest will he pay her in 6 years at $5\frac{1}{2}\%$?

(b) If he pays the debt in 5 years, what will the interest be?

24. (a) Many times business houses find it necessary to borrow money for a short time. Short-time loans are usually made for 30, 60, or 90 days. In business it is the common practice to consider the year as made up of 12 months of 30 days each or 360 days.

(b) Since the rate of interest is always for a year, if the time is given in days it will have to be changed to a part of a year by writing the number of days over 360; as, 90 days = $\frac{90}{360}$ of a year.

(c) Find the interest on \$720 at $5\frac{1}{2}\%$ for 60 days.

Given numbers	Problem
\$720 = Principal	To find the interest
$5\frac{1}{2}\% = \frac{11}{2}\% = \frac{11}{200}$ = Rate of interest	
60 days = $\frac{60}{360}$ yr. = Time	

Solution

Instead of writing in each problem the statement that Interest = Principal × Rate × Time, it may be more convenient to write just the initials of each word thus:

$$I = P \times R \times T$$

$$= \cancel{\$720} \times \frac{11}{\cancel{200}} \times \frac{\cancel{60}}{\cancel{360}}$$

$$= \frac{\$660}{100}$$

$$= \$6.60 \quad \text{Interest for 60 days}$$

NOTE. — Why was it desirable not to cancel further?

25. Find the interest in each of the following:

Principal	Rate	Time	Interest
$ 800	6%	90 da.	.....
1000	5%	30 "	.....
2500	4%	120 "	.....
500	4½%	60 "	.....
750	6½%	75 "	.....
3000	7%	150 "	.....
3500	5½%	45 "	.....
5000	6%	30 "	.....
1500	3½%	180 "	.....
75	6%	48 "	.....
100	4%	76 "	.....
300	5%	37 "	.....
250	6%	92 "	.....
400	3½%	120 "	.....
2000	8%	45 "	.....
2500	6%	90 "	.....

II. Finding Dates

1. (a) A man must pay $120 for taxes on June 20, 1919. In order to pay them, he borrowed $50 from the bank June 16. He paid the bank 6% interest for 90 days. How much extra did his taxes for that year cost him?

(b) Just as landlords have their rent paid in advance, so banks ask that their interest be paid in advance.

(c) On what date must the taxpayer repay the $50, that is, the principal that he borrowed? This date is found by counting ahead 90 days from June 16.

June 16 + 90 days = September 14

June 16 to 30 = 14 days
Number days in July = 31 "
" " " August = 31 "
76 days

90 days − 76 days = 14 days in September

2. (a) A man whose taxes due June 20, 1919, amounted to \$140, borrowed \$75 for 60 days, paying 6% interest. When must he pay the \$75 he borrowed?

(b) When this time comes, he finds he cannot pay more than \$40 of it. He pays this amount and arranges for the use of the remainder for another 60 days.

(c) How much extra do his taxes cost this man?

(d) On what date does he pay the last of his loan?

3. (a) A man wished to buy a lot for \$3000. He borrowed \$500. He paid 6% interest on it for 120 days. What was the real cost of the lot?

(b) In one year he sold the lot for \$4000. How much did he gain if taxes for the year were \$45?

(c) If, instead of buying the lot, he had lent the \$3000 at 6% for the year, how much interest would he have received?

(d) How much more did he earn by buying and selling the lot?

(e) Suppose he had not been able to sell the lot for five years, and then received \$4000 for it. Would he then have made more money by buying the lot or by lending the \$3000 for 5 years at 6%?

4. Fill in the blanks of each of the following loans:

Date of Borrowing	Amount Borrowed	Time of Loan	Rate of Interest	Interest Paid	Date the Principal is due
Jan. 1, 1918....	\$ 150	60 da.	$5\frac{1}{2}$%	.....	.....
May 18, 1918...	120	90 "	5%	.....	.....
Sept. 30, 1918..	85	90 "	6%	.....	.....
Feb. 4, 1916....	225	30 "	6%	.....	.....
Jan. 10, 1919...	560	90 "	$5\frac{1}{2}$%	.....	.....
Apr. 1, 1917....	350	60 "	5%	.....	.....
June 21, 1917...	75	30 "	6%	.....	.....
Mar. 30, 1918...	50	30 "	$6\frac{1}{2}$%	.....	.....
July 12, 1917...	1000	1 yr. 3 mo.	$5\frac{1}{2}$%	.....	.....
Oct. 28, 1918....	1250	2 yr. 4 mo.	5%	.....	.....

5. A shoe dealer bought his stock of spring and summer shoes January 15, 1920. The wholesaler gave him his choice of the following terms on his invoice of $2350:

5 % off for cash
3 % off, if paid within 30 days
2 % off, if paid in 60 days
The net amount, if paid in 90 days.

If he pays the bill under 90 days, he must borrow the amount needed from the bank at 6 % interest. Under which of the terms can he save the most?

III. Conditions for Borrowing

1. (a) Will the bank lend money to everybody who wants to borrow?

(b) Find out under what conditions the bank will lend money.

(c) What evidence does the bank have that the borrower owes it some money?

(d) If the borrower owns property and is known to be a reliable man, the bank will lend him money according to his ability to pay. But every borrower must sign a statement, promising to pay the amount of the debt within a time agreed upon. Such a statement or agreement to pay is called a *note.*

(e) One may write such a note or promise to pay, but for convenience the blank form of the note is printed, just as blank checks are printed. The printed form is always used by banks.

(f) If a person borrows from another who is not in the business of lending money, a written instead of a printed note is usually given. Either one is legal.

(g) A note is a promise to pay someone a definite sum of money on or before a given time. It may be with or without interest. The sum of money stated is called the *face* of the note.

IV. Examples of Notes

$ 215.50 Munsen, Indiana, Dec 3, 1914

Sixty days after date we promise to pay

to the order of Hall Lumber Hardware Company

TWO HUNDRED FIFTY SIX DOLLARS FIFTY CENTS Dollars

Payable at First National Bank, Munsen

Value received

No 647 Due Feb 7, 1915 Milton Supply Company

U.S. Bonds

A Written Note, Without Interest

$ _____ Columbus, Ohio, _____ 191_

_____ after date, for value received, we jointly and severally promise to pay _____

_____ or order, at _____

_____ Dollars

with interest _____ at the rate of _____ per cent per annum, payable annually

And ___ do hereby authorize _____ Attorney at Law to appear for ___ in ___ action on the above note, at any time after said note becomes due, in any Court of Record, in or of the State of Ohio, to waive the issuing and service of process against ___, and confess a judgment in favor of the legal holder of the above against ___, for the amount that may then be due thereon, with interest at the rate therein mentioned, and costs of suit; and to waive and release all errors in said proceedings, petitions in error, and the right of appeal from the judgment rendered.

Witness our hands and seals.

No. _____ _____ (SEAL)

Due _____ _____ (SEAL)

_____ (SEAL)

U.S. Bonds THE COLUMBUS BLANK BOOK MFG. CO. COLUMBUS, OHIO _____ (SEAL)

A Judgment Note

The kind of note commonly used is one that provides for the collection of the amount due on it, in case the maker fails to pay it. A note of this kind is called a *judgment note.*

2. (a) Banks, and sometimes insurance companies, require that interest be paid in advance. Usually other firms and individual lenders do

not. If the loan is for more than a year, the interest is usually paid annually. If it is for less than a year, the whole debt, the principal plus the interest, is paid in one amount at the time it is due.

(b) This sum of the principal plus the interest is called the *amount.*

3. (a) A senior in college borrowed \$300 for $2\frac{1}{2}$ years at 6%. At the end of each year, he paid the interest due. What was the amount he owed at the final settlement?

(b) What amount would he have owed, if he had paid no interest until the payment of the debt?

4. If no interest is paid until the final settlement of the following loans, what amount is due on each? Fill in all the blanks.

Face of Note	Date of Note	Time of Note	Date Due	Rate of Interest	Interest	Amount
\$ 650.00	Jan. 1, 1918..	90 da.	.....	5%	.....	.....
980.50	May 12, 1919..	6 mo.	.....	$5\frac{1}{2}$%	.....	.....
1250.00	Dec. 15, 1920..	120 da.	.....	5%	.....	.....
768.75	July 6, 1917..	60 da.	.....	7%	.....	.....
752.00	Jan. 25, 1920..	60 da.	.....	6%	.....	.....
845.00	Jan. 20, 1920..	2 mo.	.....	6%	.....	.....
536.80	Mar. 15, 1919..	30 da.	.....	$5\frac{1}{2}$%	.....	.....
4800.00	Feb. 1, 1918..	90 da.	.....	5%	.....	.....
2575.00	Feb. 1, 1918..	3 mo.	.....	$5\frac{1}{2}$%	.....	.....
368.75	Apr. 5, 1918..	4 mo.	.....	7%	.....	.....

O. READING INTEREST FROM TABLES

1. (a) Banks, insurance companies, and other business houses that have many calculations of interest to make, usually use interest tables from which the required interest may be read directly or with very little calculation.

(b) These interest tables are in book form. Each double page may be divided into 30 rectangles. Each rectangle contains a table for a different number of days at a given rate of interest. Twelve double pages give the interest for all the days of the year for one rate of interest.

(c) Usually the books contain tables for 5, 6, 7, and 8 %; for, from these, interest at other rates may be computed. For example, to find 1 %, one may double the 5 % interest which gives 10 %. By pointing off one decimal place to the left one easily finds 1 %.

(d) By pointing off one decimal place to the left in the 5 % table $\frac{1}{2}$ % may be found. Why is this correct?

(e) How may 2 % be found from the 6 % table? from the 8 % table?

(f) How may $2\frac{1}{2}$ % be found from the 5 % table?

(g) How can you most easily find 3 %? $3\frac{1}{2}$ %? 4 %?

(h) Some books have a 9 % table. If so, how can you find $4\frac{1}{2}$ %? If not, how can you find $4\frac{1}{2}$ %?

(i) There are other large books that give the interest for all rates and quarter rates from 1 to 10 %, as 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{4}$, etc.

2. How to Read Interest Tables

(a) Read the interest for 16 days at 6 % on \$2000.

(b) In the 16-day table, opposite the large figure 2, count over three circles, for there are three zeros in 2000.

(c) The small figures in these three circles 5 3 3 counted as cents give the interest required, or \$5.33.

(d) The interest for \$20,000 would count the figures in 4 circles as cents 5 3 3 3 or \$53.33.

The interest for $200 would be found in the first two circles or $.53.

6% INTEREST TABLE

PART OF ONE PAGE OF 6% TABLE

The illustration gives six samples out of the 30 tables for one month.*

16 Days. 6%		21 Days. 6%		26 Days. 6%	
1	2666	1	3500	1	4333
2	5333	2	7000	2	8666
3	8000	3	10500	3	13000
4	10666	4	14000	4	17333
5	13333	5	17500	5	21666
6	16000	6	21000	6	26000
7	18666	7	24500	7	30333
8	21333	8	28000	8	34666
9	24000	9	31500	9	39000
17 Days. 6%		**22 Days. 6%**		**27 Days. 6%**	
1	2833	1	3666	1	4500
2	5666	2	7333	2	9000
3	8500	3	11000	3	13500
4	11333	4	14666	4	18000
5	14166	5	18333	5	22500
6	17000	6	22000	6	27000
7	19833	7	25666	7	31500
8	22666	8	29333	8	36000
9	25500	9	33000	9	40500

* Copyright by Imperial Publishing Company, Grand Rapids, Michigan.

3. Read the interest for 16, 17, 21, 22, 26, and 27 days at 6 % on

(a) \$1, \$10, \$100, \$1000, \$10,000.

(b) \$2, \$20, \$200, \$2000, \$20,000.

(c) Read the corresponding numbers based on 3, 4, 5, 6, 7, 8, and 9.

(d) Notice that when the first figure passes from 9 to 10, the extra 1 is put outside the circles. No matter what figures are outside the circles, fix the amount and the decimal point by counting the circles as before.

(e) In the 17-day table at 6 %, the interest opposite figure 5 is 1 4 1 6 6.

If you want the interest on \$500, you must count the first two circles, which give \$1.41. But since the third circle is over 5 mills, or $\frac{1}{2}$ cent, another cent must be added to \$1.41. The interest, therefore, is \$1.42.

4. How to Read Other Numbers

(a) To read the interest on \$5260, it must be separated into parts, thus: \$5260 = \$5000 + \$200 + \$60.

Interest on \$5000 for 16 da.						=	\$13.33
"	"	200	"	"	"	=	.53
"	"	60	"	"	"	=	.16
Interest on \$5260 for 16 da.						=	\$14.02

(b) Check this interest by computing it in the usual way.

5. From the table find the interest on 6 % on

(a) \$4,600 for 21 days

(b) 9,750 for 27 days

(c) 58,400 for 22 days

(d) 3,580 for 17 days

(e) 96,000 for 26 days

(f) 8,375 for 16 days

(g) 2,050 for 21 days
(h) 30,500 for 27 days
(i) 10,875 for 22 days
(j) 6,240 for 26 days

5% INTEREST TABLE

PART OF ONE PAGE OF 5% TABLE

6 Months 1 Day. 181 Days. 5%		6 Months 6 Days. 186 Days. 5%		6 Months 11 Days. 191 Days. 5%	
1	2.51.38	1	2.58.33	1	2.65.27
2	5.02.77	2	5.16.66	2	5.30.55
3	7.54.16	3	7.75.00	3	7.95.83
4	10.05.55	4	10.33.33	4	10.61.11
5	12.56.94	5	12.91.66	5	13.26.38
6	15.08.33	6	15.50.00	6	15.91.66
7	17.59.72	7	18.08.33	7	18.56.94
8	20.11.11	8	20.66.66	8	21.22.22
9	22.62.50	9	23.25.00	9	23.87.50
6 Months 2 Days. 182 Days. 5%		**6 Months 7 Days. 187 Days. 5%**		**6 Months 12 Days. 192 Days. 5%**	
1	2.52.77	1	2.59.72	1	2.66.66
2	5.05.55	2	5.19.44	2	5.33.33
3	7.58.33	3	7.79.16	3	8.00.00
4	10.11.11	4	10.38.88	4	10.66.66
5	12.63.88	5	12.98.61	5	13.33.33
6	15.16.66	6	15.58.33	6	16.00.00
7	17.69.44	7	18.18.05	7	18.66.66
8	20.22.22	8	20.77.77	8	21.33.33
9	22.75.00	9	23.37.50	9	24.00.00

7% INTEREST TABLE

PART OF ONE PAGE OF 7% TABLE

2 Months 1 Day. 61 Days. 7%		2 Months 6 Days. 66 Days. 7%		2 Months 11 Days. 71 Days. 7%	
1	1.86	1	1.89	1	1.92
2	2.72	2	2.78	2	2.83
3	3.58	3	3.67	3	4.75
4	4.44	4	5.33	4	5.67
5	5.31	5	6.17	5	6.58
6	7.17	6	7.00	6	8.33
7	8.03	7	8.83	7	9.67
8	9.47	8	10.67	8	11.08
9	10.67	9	11.50	9	12.42
2 Months 2 Days. 62 Days. 7%		**2 Months 7 Days. 67 Days. 7%**		**2 Months 12 Days. 72 Days. 7%**	
1	1.25	1	1.30	1	1.40
2	2.41	2	2.60	2	2.80
3	3.61	3	3.90	3	4.20
4	4.82	4	5.21	4	5.60
5	6.02	5	6.51	5	7.00
6	7.23	6	7.81	6	8.40
7	8.43	7	9.11	7	9.80
8	9.64	8	10.42	8	11.20
9	10.85	9	11.72	9	12.60

8% INTEREST TABLE

PART OF ONE PAGE OF 8% TABLE

9 Months 19 Days. 289 Days. 8%		9 Months 24 Days. 294 Days. 8%		9 Months 29 Days. 299 Days. 8%	
1	6.42222	1	6.53333	1	6.64444
2	12.84444	2	13.06666	2	13.28888
3	19.26666	3	19.60000	3	19.93333
4	25.68888	4	26.13333	4	26.57777
5	32.11111	5	32.66666	5	33.22222
6	38.53333	6	39.20000	6	39.86666
7	44.95555	7	45.73333	7	46.51111
8	51.37777	8	52.26666	8	53.15555
9	57.80000	9	58.80000	9	59.80000

9 Months 20 Days. 290 Days. 8%		9 Months 25 Days. 295 Days. 8%		10 Months. 300 Days. 8%	
1	6.44444	1	6.55555	1	6.66666
2	12.88888	2	13.11111	2	13.33333
3	19.33333	3	19.66666	3	20.00000
4	25.77777	4	26.22222	4	26.66666
5	32.22222	5	32.77777	5	33.33333
6	38.66666	6	39.33333	6	40.00000
7	45.11111	7	45.88888	7	46.66666
8	51.55555	8	52.44444	8	53.33333
9	58.00000	9	59.00000	9	60.00000

6. From the tables find the interest on

(a) $ 3,450 for 182 days at 5 %

(b) 4,225 for 294 days at 8 %

(c) 60,840 for 187 days at $2\frac{1}{2}$ %

(d) 12,500 for 66 days at 7%
(e) 865 for 300 days at 4%
(f) 8,040 for 71 days at $3\frac{1}{2}$%
(g) 16,250 for 27 days at 3%
(h) 3,600 for 21 days at 2%
(i) 56,860 for 181 days at $2\frac{1}{2}$%
(j) 4,800 for 67 days at 7%
(k) 375 for 192 days at 5%
(l) 9,080 for 290 days at 4%
(m) 90,680 for 191 days at $2\frac{1}{2}$%
(n) 88,880 for 17 days at 3%
(o) 50,500 for 295 days at 8%
(p) 60,950 for 72 days at $3\frac{1}{2}$%

P. OTHER PROBLEMS IN INTEREST

I. Finding the Principal

1. (a) What is the interest on \$500 at 6% for one year?

(b) We have found that

$$\text{Interest} = \text{Principal} \times \text{Rate} \times \text{Time}$$
$$\text{or} \quad I = P \times R \times T$$

(c) But if the time is one year, then the factor time need not be considered, for

$$1 \times P \times R = P \times R$$

(d) Read the above statement in a complete sentence.

(e) Therefore, Interest for one year = Principal × Rate

$$\text{or} \quad I = P \times R$$
$$= \$500 \times .06$$
$$= \$30$$

(f) We find that the interest for one year is always the product of two factors, the principal and the rate, just as 12 is the product of two factors, 4 and 3 or 6 and 2.

$$\text{If} \quad 12 = 4 \times 3,$$
$$\text{does } 4 \times 3 = 12?$$

The two members of an equation may be interchanged without destroying their equality. This interchange reverses the equation.

(g) If 4 pencils cost 12 cents, we may abbreviate the statement and write

$$4 \times p = 12$$

(h) The equality sign between two numbers means that they are exactly equal.

(i) Will the two numbers still be equal if both of them are divided by the same number?

$$\text{Since } 4 \times 3 = 12,$$
$$\text{does } \frac{4 \times 3}{4} = \frac{12}{4}?$$

If you actually make this division, you get a true statement that

$$3 = 3$$

(j) If we use the statement about the pencils, namely, $4 \times p = 12$, we may divide both parts in the same way.

$$\frac{4 \times p}{4} = \frac{12}{4}$$

By actually making the division we get

$$p = 3$$

This is just a short way of saying that if 4 pencils cost 12 cents, one pencil costs 3 cents.

(k) If two equal quantities are divided by the same number, are the two quotients equal?

2. If I want to find out what sum of money lent for a year at 6% will bring in \$30 interest, I may use the same statement that was used to find interest, or I may reverse the statement.

Solution	Illustration
$I = P \times R$	$12 = 4 \times 3$
$R \times P = I$	$3 \times 4 = 12$
We know that $R = 6\% = .06$	
and $I = \$30$,	
therefore we may put these numbers in place of the letters	
$.06 \times P = \$30$	$4p = 12$
Divide both parts by .06	
$\frac{.06 \times P}{.06} = \frac{\$30}{.06}$	$\frac{4p}{4} = \frac{12}{4}$
$P = \$500$	$p = 3$

3. How much money must I put into a business that pays 7 % to bring me in an income of \$3500?

4. How much money lent at 6 % interest will earn \$2400 a year?

5. A man has a mortgage on his home on which he pays \$270 interest at 6 %. What is the amount of the mortgage?

6. (a) A man plans to live on the interest from his savings after he is fifty years old. He knows he can get 4 % and wants an income of \$2000. How much must he save?

(b) If he can get 5 % interest, how much must he save?

7. If a man pays \$275 interest on a mortgage at $5\frac{1}{2}$ %, what is the amount of the mortgage?

8. (a) How much have you lent the Government if it pays $4\frac{1}{2}$ % interest and you receive \$90 a year?

(b) How much have you lent if you receive \$135 a year?

9. If an investment pays $7\frac{1}{2}$ % and brings in \$1500 a year, what is the amount of the investment?

10. Find the amount of investment or principal necessary to produce the given income at the given rate.

Income or Interest	Rate of Interest	Investment or Principal
$ 157.50	$4\frac{1}{2}\%$	.....
231.00	$5\frac{1}{2}\%$	.....
1575.00	7%	.....
990.00	6%	.....
243.75	5%	.....
168.75	$4\frac{1}{2}\%$	.....
1700.00	4%	.....
42250.00	$6\frac{1}{2}\%$	.....

II. Finding the Rate of Interest

1. (a) Instead of finding the interest or the principal, I may want to find at what rate I must lend $500 to bring in $30 in one year.

(b) Illustrated Problem:

Given
$P = \$500$
$I = \$\ 30$

Problem
To find the rate of interest

Solution

$$P \times R = I$$
$$500 \times R = 30$$
$$\frac{500 \times R}{500} = \frac{30}{500}$$ Give reason
$$R = \frac{3}{50}$$
$$= .06$$
$$= 6\%$$ Rate of interest

(c) You are already familiar with this kind of problem of finding what per cent one number is of another. Putting it in this form shows why the one number divided by the other gives the per cent or rate.

2. At what rate must I lend $1200 to produce $150 a year?

3. The interest on $6500 is $292.50 a year. What is the rate of interest?

4. If I pay $264 a year on a $4800 mortgage, what rate of interest do I pay?

5. I have money invested in two concerns. From the first I receive annually \$450 and have \$7500 invested. From the second I receive \$442 and have \$6800 invested. Which is the better investment? How much better is it?

6. (a) Make up four problems to find the principal.
(b) Make up four problems to find the rate of interest.
(c) Solve your own problems.
(d) Exchange with a classmate and solve his set.
(e) Examine and grade your own set.
(f) How many per cent should be given to each problem solved correctly?

Q. HOW TO MAKE MONEY WORK

I. Savings Banks

1. (a) We have seen that banks are safe and convenient places for depositing one's money, so that one can pay debts by check. A bank account that one may draw on is called a *checking account* or a *commercial account.*

A checking account does not earn any interest, but it is a great convenience. Explain how.

(b) Besides a checking account, everyone who earns money should open a savings account. Every boy or girl who can earn or save a dollar may open a savings account and thus make the dollar work for him. If the dollar is spent on candy, ice cream, and picture shows, it gives only temporary pleasure. But if it is put in the bank in a savings account, it will grow and grow. The younger you are when you put it in, the larger it will grow. But you must not touch the dollar while it is working for you. If left long enough, it will grow into \$200, \$300, or more.

(c) The way money works for you is by earning interest. In some banks money earns 4% interest; in others $4\frac{1}{2}$% or 5%. How much interest does it earn if left in a toy bank at home?

2. (a) On a little boy's first birthday, his father put \$100 in a savings bank for him. This bank paid 4% interest a year, but paid it every 6 months.

(b) By the time he was 21 years old, this \$100 had grown to be almost \$221, for he had not taken out any interest.

(c) If he had put the money in a savings bank that paid 5% interest, the \$100 would have grown to \$268.50.

3. (a) Let us see how this \$100 grew.
At 4% how much interest did the \$100 earn the first 6 months?

(b) This \$2 interest might be taken out or left in the bank to earn more money. Which is the better plan?

(c) If the interest is left in, how much money is working for the boy the second 6 months? How much does it earn?

(d) Since the bank pays 4% interest each year, it pays 2% each half year, or every 6 months. Compare the interest for each 6 months with the next. How do the two amounts compare?
See the following calculation:

\$100.00	Deposited when boy was 1 yr. old
2.00	2% for first 6 months
102.00	Amount when $1\frac{1}{2}$ yr. old
2.04	2% for second 6 months
104.04	Amount when 2 yr. old
2.08	2% for third 6 months
106.12	Amount when $2\frac{1}{2}$ yr. old
2.12	2% for fourth 6 months

108.24	Amount when 3 yr. old
2.17	2% for fifth 6 months
110.41	Amount when $3\frac{1}{2}$ yr. old
2.21	2% for sixth 6 months
112.62	Amount when 4 yr. old
2.25	2% for seventh 6 months
114.87	Amount when $4\frac{1}{2}$ yr. old
2.30	2% for eighth 6 months
117.17	Amount when 5 yr. old
2.34	2% for ninth 6 months
119.51	Amount when $5\frac{1}{2}$ yr. old
2.39	2% for tenth 6 months
121.90	Amount when boy was 6 yr. old after money worked 5 yr.

(e) Continue the calculation and find out to what amount the $100 has grown at the end of 10 years.

4. (a) If money is drawing interest, and this interest is left in the bank to draw more interest, thus making the amount of money grow faster, the interest is called *compound interest.*

(b) If interest is compounded every year, or annually, it does not increase quite as rapidly as when compounded semi-annually, or every six months.

(c) Interest may be compounded quarterly, or every three months.

II. Compound Interest Table

1. (a) The computation of compound interest is a tedious task. Therefore bankers have tables prepared which show what $1 amounts to when earning interest in a savings bank; that is, when it is drawing compound interest.

(b) The tables show the different amounts for the different periods of time and for several of the most common rates of interest.

Compound Interest Table

Showing the amount of $1 at compound interest at four different rates, for any period of time up to 50.

Periods	Rate for Period			
	2%	2½%	4%	5%
1	1.0200	1.0250	1.0400	1.0500
2	1.0404	1.0506	1.0816	1.1025
3	1.0612	1.0769	1.1249	1.1576
4	1.0824	1.1038	1.1699	1.2155
5	1.1041	1.1314	1.2167	1.2763
6	1.1262	1.1597	1.2653	1.3401
7	1.1487	1.1887	1.3159	1.4071
8	1.1717	1.2184	1.3686	1.4775
9	1.1951	1.2489	1.4233	1.5513
10	1.2190	1.2801	1.4802	1.6289
11	1.2434	1.3121	1.5395	1.7103
12	1.2682	1.3449	1.6010	1.7959
13	1.2936	1.3785	1.6651	1.8856
14	1.3195	1.4130	1.7317	1.9799
15	1.3459	1.4483	1.8009	2.0789
16	1.3728	1.4845	1.8730	2.1829
17	1.4002	1.5216	1.9479	2.2920
18	1.4282	1.5597	2.0258	2.406¢
19	1.4568	1.5987	2.1068	2.5270
20	1.4859	1.6386	2.1911	2.6533
21	1.5157	1.6796	2.2788	2.7860
22	1.5460	1.7216	2.3699	2.9253
23	1.5769	1.7646	2.4647	3.0715
24	1.6084	1.8087	2.5633	3.2251
25	1.6406	1.8539	2.6658	3.3864
26	1.6734	1.9003	2.7725	3.5557
27	1.7069	1.9478	2.8834	3.7335
28	1.7410	1.9965	2.9987	3.9201
29	1.7758	2.0464	3.1187	4.1161
30	1.8114	2.0976	3.2434	4.3219
31	1.8476	2.1500	3.3731	4.5380
32	1.8845	2.2038	3.5081	4.7649
33	1.9222	2.2589	3.6484	5.0032
34	1.9607	2.3153	3.7943	5.2533
35	1.9999	2.3732	3.9461	5.5160
36	2.0399	2.4325	4.1039	5.7918
37	2.0807	2.4933	4.2681	6.0814
38	2.1223	2.5557	4.4388	6.3855
39	2.1647	2.6196	4.6164	6.7048
40	2.2080	2.6851	4.8010	7.0400
41	2.2522	2.7522	4.9931	7.3920
42	2.2972	2.8210	5.1928	7.7616
43	2.3432	2.8915	5.4005	8.1497
44	2.3901	2.9638	5.6165	8.5572
45	2.4379	3.0379	5.8412	8.9850
46	2.4866	3.1139	6.0748	9.4343
47	2.5363	3.1917	6.3178	9.9060
48	2.5871	3.2715	6.5705	10.4013
49	2.6388	3.3533	6.8333	10.9213
50	2.6916	3.4371	7.1067	11.4674

2. (a) From the table find out what \$5 will amount to if left in a savings bank 5 years at 4% interest, compounded annually.

(b) How much will it amount to if the interest is compounded semi-annually?

3. (a) During the war the Government borrowed money by selling War Savings Stamps. If you bought one in January, 1918, you paid \$4.12 for it. In January, 1923, you receive \$5 for it.

(b) If the Government pays 4% interest, compounded annually, find out how near \$5 the exact amount is.

(c) Is the difference in your favor or the Government's?

4. From your table find out how many years it takes \$1 to become \$2, if the interest at 4% is compounded semi-annually.

5. At that rate how much will \$500 amount to in $17\frac{1}{2}$ years? in 35 years? in $52\frac{1}{2}$ years? in 70 years?

6. If you put \$10 in a savings bank now, how much will you have when you are 21, if the bank pays 5%, compounded semi-annually?

7. At 5% interest, compounded semi-annually, how long does it take a dollar to become \$2?

8. (a) If your father put \$100 in a savings bank for you when you were born, how much will it be worth when you are 14 years old, if you receive 5% interest, compounded semi-annually?

(b) At this rate how much will you have when you are 28 years old ?

9. (a) If, instead of spending 10 cents for an ice cream soda when you were 10 years old, you had stopped to consider that each 10 cents would be \$1.15 by the time you are 60 years old, if the money earns 5%, interest compounded annually, do you think you would spend as many dimes as you do on such luxuries?

(b) On an average how much do you spend a week for soda, candy, gum, and picture shows?

(c) How much does it amount to in a year?

(d) Suppose you spend half as much and put the other half in a savings bank to draw 5 % interest, compounded annually, how much would your savings for a year amount to in 20 years? in 25 years? in 50 years?

III. Periodical Investment Table

1. (a) If you save $1 every year and put it in a savings bank at 5 %, compounded annually, in 20 years you will have $34.72 instead of $20.

(b) At the same rate, how much will you have if you save $10 a year?

PERIODICAL INVESTMENT TABLE

Showing the amount of $1 at compound interest, if an additional $1 is saved and invested at the end of each interest period, whether that be a year or part of a year.

Periods	4%
1	1.0400
2	2.1216
3	3.2465
4	4.4163
5	5.6330
6	6.8983
7	8.2142
8	9.5828
9	11.0061
10	12.4864
11	14.0258
12	15.6268
13	17.2919
14	19.0236
15	20.8245
16	22.6975
17	24.6454
18	26.6712
19	28.7781
20	30.9692

2. If you begin saving when you are 10 years old and save \$25 a year, receiving 4% interest, compounded annually, how much will you have when you are 30 years old?

3. At 20 years of age, if you save an additional \$50 a year under the same conditions, how much will you have from both savings by the time you are 30 years old?

R. COMMUNITY PRIVILEGES

I. Rural or Urban Communities

1. What did you have for breakfast this morning that you could not have had, if you lived alone on some island instead of among people?

2. What do you have to wear that you could not have if you lived alone?

3. What comforts and conveniences do you have in your home, just because you live among people?

4. If you live in a city, what conveniences and privileges do you have that you would lack if you lived in a rural community?

5. Would your needs be the same if you lived in the country or in a village as if you lived in a city? Why?

6. (a) If a farmer's house or barn catches fire, who puts the fire out?

(b) Why must city people pay for fire protection?

7. Compare the need of police protection in the country and in the city.

8. Where does the farmer get his water supply? Where does the city man get it?

9. Why are good roads and paved streets necessary? Who should pay for them?

10. (a) In a country like ours should every boy and girl have the privilege of going to school, or only those who can pay for it?

(b) Who pays for the free public school education?

II. How Privileges Are Paid For — Taxes

1. (a) How do people pay for these privileges of living together in communities that individuals cannot get for themselves?

(b) Do only a few people get the benefit of them or does everybody?

(c) Who, then, should pay the taxes?

The money paid to the city or other government for furnishing the conveniences and protection to the people is called *taxes*.

2. The amount of taxes a person pays depends upon his ability to pay. The city, county, and state officials who attend to the government business plan a year's budget to find out how much money is needed. They find out how much property there is to be taxed, and calculate what per cent of its value must be paid for taxes.

3. (a) In 1918 every person that owned property in Columbus paid as taxes 1.4% of its value as listed with the Government.

(b) Mr. Albright owns property in Columbus valued at $16,000. How much taxes did he pay in 1918?

(c) Mr. Beacon's property is worth $25,750. What were his taxes in 1918?

(d) The 1.4% is the *tax rate*, or *rate of taxation*.

(e) If the tax rate in Columbus for 1919 is 1.56%, how much taxes does each of these men pay, if there is no change in the valuation of their property?

4. How much tax does Mr. Clark pay on $5400 worth of property if the tax rate is 1.8 %?

5. How much does Mr. Dean pay on property valued at $245,300, if the rate of taxation is 1.47 %?

6. Mr. Evans has five pieces of property:

(a) A house and lot valued at..... $ 1,250
(b) " " " " " " 2,750
(c) " " " " " " 3,300
(d) A vacant lot valued at..... 800
(e) A store building and lot valued at. 18,000

If the tax rate for 1917 was 1.36 %, for 1918, 1.43 %, and for 1919, 1.58 %, how much taxes did he pay on each piece of property each year, if there was no change in valuation?

7. (a) The rate of taxation is a per cent of the value of the property. But it may be stated in several ways. A tax rate of 1.45 % means

1.45	cents	paid	on every	$1.00 of valuation
$.0145	"	"	"	$1.00
14.5	mills	"	"	$1.00
$1.45	"	"	"	$100.00
$14.50	"	"	"	$1000.00

(b) No matter which form is used to show the rate, it is the same per cent.

(c) Show that 14.5 mills on $1 is the same per cent as $1.45 on $100.

8. What is the per cent of taxation, if the rate is

(a) 16 mills on a dollar of valuation?
(b) $17.80 on each $1000 of valuation?
(c) $2.40 on each $100 of valuation?
(d) 15.6 mills on each dollar of valuation?

9. Find the tax paid on the following valuations of property at the given rate of taxation for each:

Valuation of Property	Rate of Taxation	Tax Paid
$ 2,200	1.6%	.....
3,450	17.5 mills on $1	.....
925	$2.14 on $100	.....
10,650	$0.0189 on $1	.....
355,750	$15.60 on $1000	.....
48,500	1.9%	.....
6,700	15.8 mills on $1	.....
4,260	$1.87 on $100	.....
5,675	$16.70 on $1000.	.....
2,880	$0.0139 on $1	.....

10. (a) Find the present tax rate in your community.

(b) Compute the taxes paid by persons in your community whose property valuations are as follows:

(1) $ 1,780
(2) 7,650
(3) 10,000
(4) 8,750
(5) 18,000
(6) 45,600
(7) 550,000
(8) 12,800

11. Why are taxes in rural communities lower than those in near-by cities?

12. There are other kinds of taxes besides those on property that bring money into the treasuries of the city, county, state, and nation. If you are interested, find out what these other sources of income are.

III. Transportation and Mail

1. (a) There are many other community privileges for which we do not pay as directly as for those for which we pay taxes. The opportunity of earning money or doing business comes from people's living together.

(b) Instead of its taking a week to go on horseback or in a carriage from Philadelphia to New York, we now have a network of railroads all over the country and in less than a week can go from New York to San Francisco.

(c) These railroads and the Government make it possible to get mail at least once a day. In many places there are three or four deliveries daily.

(d) The railroads, the post office, the express and telegraph companies offer various ways of sending money safely, and thus make it possible for one in Boston to do business with another in Chicago or St. Louis.

(e) Find out what a bank draft is and how it is used.

(f) If you were away at college and needed money from home, what would be the quickest way to get it?

(g) Find out how to send money by post office order; by express order; by telegraph.

IV. Special Fire Protection

1. (a) No matter whether one lives in the city or in the country, one's house and household belongings are in danger of fire.

(b) In which community is the danger greater?

(c) In which is the protection greater?

(d) Most people want more protection against loss of property by fire. For this reason certain companies go into the business of insuring property against loss by fire, or insuring plate glass against breakage. Such companies are known as *insurance companies.*

(e) The owner of the property and the insurance company sign a contract, called a *policy*, which describes the property, gives the amount for which it is insured, and the amount the owner pays for the insurance.

(f) The owner of a house or building usually insures it for $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, or $\frac{4}{5}$ of its value.

2. (a) A \$5000 house is insured for 80% of its value. The owner pays \$.50 for each \$100 of insurance. How much does he pay for the insurance; that is, how much *premium* does he pay?

(b) Solution:

Given numbers	To find
\$5000 = Value of property	premium
80% = Part of property insured	
\$.50 per \$100 = .005 per \$1 = Rate of insurance	

Process

80% of \$5000 = $\frac{4}{5}$ of \$5000
= \$4000 Insured value
\$4000 × .005 = \$20 Premium
or
40 × \$.50 = \$20 Premium

3. Usually fire insurance is taken for a longer time than one year. If policies are written for 3 years, twice the annual rate is charged; if for 4 years, $2\frac{1}{2}$ times the annual rate is charged; and if for 5 years, 3 times the annual rate.

4. An apartment house valued at \$48,000 is insured at three-fourths of its value at the annual rate of \$.75 a \$100. What is the premium if it is insured for 3 years? for 5 years?

5. A farmer insured his house, barns, and their contents for \$7500, which is three-fourths of the real value. He paid at the rate of \$.50 a \$100. What premium did he pay for 3 years' insurance? for 5 years' insurance?

6. Find the premiums on the following policies:

Value of Property	Part of Property Insured	Annual Rate per $100	Time of Policy	Premium
$ 3,600	80%	$ .60	1 yr.	.....
4,000	$\frac{3}{4}$	.40	3 yr.	.....
7,500	$\frac{2}{3}$	.75	5 yr.	.....
9,000	75%	.50	4 yr.	.....
8,500	$\frac{4}{5}$	1.00	3 yr.	.....
15,000	$66\frac{2}{3}$%	.90	5 yr.	.....
180,000	80%	.75	5 yr.	.....
4,500	$\frac{3}{4}$	.80	3 yr.	.....

There are many other kinds of insurance besides that against loss by fire. One, insuring plate glass, especially in store windows, has been mentioned. Among other kinds of insurance are life insurance; marine, that is, of ships and their cargoes; accident insurance; burglary insurance; and automobile insurance. Perhaps you can think of some other kinds. All property insurance is similar to fire insurance.

CHAPTER THREE

NECESSARY RECORDS IN BUSINESS

A. PERSONAL WEEKLY ACCOUNTS

1. (a) A boy decides to keep a record of the money he receives and the money he spends.

(b) Saturday, November 1, 1919, he receives $3 from his father as his weekly allowance. His father expects him to buy his school supplies with this. The boy earns some extra money.

Mon., Nov. 3, he buys an English book	$ .90
Notebook	.25
Luncheon	.15
Tues., Nov. 4, he buys a pencil	.05
Luncheon	.18
He sells pocket knife	.75
Wed., Nov. 5, he buys luncheon	.12
Ticket to school entertainment	.10
Manual Training supplies	1.00
Thurs., Nov. 6, he sells a magazine rack	5.00
Buys luncheon	.15
Tablet	.05
Candy	.10
Fri., Nov. 7, he buys luncheon	.25
Picture show	.10
Buys knife	1.25

Sat., Nov. 8, he receives for work in grocery store. 1.00
Buys a gift for mother..... .75
Puts in savings bank..... 2.00
Sun., Nov. 9, Sunday School and church..... .10

(c) This boy decides to classify his record, writing the money he receives on one page and the money he spends on the opposite page. The illustration below shows the way it looks.

(d) (1) What is the advantage of using a double page?
(2) What are his total cash receipts? his total expenses, or cash payments?

Cash Receipts

	L. F.					
1919						
Nov. 3		Father	3	00		
4		Knife		75		
6		Magazine rack	5	00		
8		Grocery store	1	00		
		Total receipts			9	75
					9	75
Nov. 9		Balance	2	25		

(3) How can he find the balance of cash on hand at the end of the week?

(4) Why is it a good plan to add the balance to the total cash payments?

(5) Should the sum of the total cash payments and the balance of cash on hand exactly equal the total receipts?

(6) When these sums are equal and are written on the same line opposite each other, the account is balanced.

(7) After the account is balanced, where are the double lines drawn?

(8) In continuing the account, why is the balance placed on the cash receipt side?

Cash Payments

	L. F.					
1919						
Nov. 3		English book		90		
		Notebook		25		
		Luncheon		15		
4		Pencil		05		
		Luncheon		18		
5		Luncheon		12		
		Entertainment		10		
		Manual Training supplies	1	00		
6		Luncheon		15		
		Tablet		05		
		Candy		10		
7		Luncheon		25		
		Picture show		10		
		Knife	1	25		
8		Gift (mother)		75		
		Savings bank	2	00		
9		Sunday School — Church		10		
		Total payments			7	50
9		Balance			2	25
					9	75

2. (a) Several of this boy's friends liked his idea of a cashbook so much that each decided to keep his own account in the same way.

(b) The first accounts they kept are given below.

(c) Write each one in cashbook form.

(d) Balance and rule the cashbook. Bring the balance down on the cash receipt side as a beginning of the next week's account

1919

(1) Dec. 2 Ralph Brown receives
From his father $2.00
Buys French book ..... .53
Luncheon ..... .19
3 Pencil ..... .05
Luncheon ..... .15
4 Receives for errand ..... .25
Buys luncheon ..... .20
Candy ..... .05
5 Sells second-hand book ..... .25
Buys tablet ..... .05
Luncheon ..... .18
Buys 2 Thrift Stamps ..... .50
6 Buys luncheon ..... .21
Picture show, self and friend .... .20
Rec'd from mother ..... .25
Gift for uncle ..... .50
Buys ice cream ..... .05
Work in drug store ..... .75
7 Sunday School ..... .05

1919

(2) Dec. 9 James Tracey received
From his mother ..... $ .15
Buys luncheon ..... .11
10 From his father ..... .25

	Buys tablet	.05
	Luncheon	.15
11	From his mother	1.50
	Buys gym. shoes	1.00
	Notebook	.25
	Luncheon	.12
12	From his mother	.15
	Work at school in lunch room	.15
	Buys luncheon	.15
13	From his mother	.20
	For errand	.10
	Buys luncheon	.15
	From his uncle	.25
	Work in grocery	.50
	Bought papers	.35
	Sold papers	.98
	Put in savings bank	1.50
14	Found	1.00
	From his mother	.05
	Sunday School	.05

1919

(3) Nov. 30	Louise Allston receives	
	From her father	$5.00
	Sunday School and church	.10
Dec. 1	Buys handkerchiefs	.25
	Gloves	1.00
	Luncheon	.25
2	Buys music	.50
	Luncheon	.20
3	Buys ice cream, self and friend	.20
	Notebook	.25
	Pencil and pen	.10
	Luncheon	.21
4	From her uncle	1.00

	Picture show, self and friend	.20
	Sold fancy work	.75
5	Gives music lesson	.50
	Buys flowers for sick friend	.25
	Luncheon	.20
6	From her sister	.50
	Buys lace	.48
	Embroidery thread	.15
	Tooth paste	.25
	Buys gift	1.00
	Theater ticket	.75

(4) Margaret Dosser's father gives her $5 a week as an allowance. With this she is expected to pay her small expenses and save some money. After writing her account in the cashbook, look it over and decide how she could have saved more.

1920

May 12	Allowance	$5.00
	Buys ticket to lecture	.50
	Sends flowers as gift	.75
13	Picture show	.10
14	Buys luncheon	.30
	Ribbon	.55
15	Orphanage fund	.30
	Buys Thrift Stamps	.50
	Violin string	.15
	Buys luncheon	.30
	Candy	.20
17	From her father	5.00
	Buys gasoline	2.50
	Luncheon	.30
18	Buys ticket to theater	.50
	Luncheon	.30

(5) Alvin Hart's father gives him money each day just as he thinks he needs it. Besides, Alvin makes money by selling papers.

1920

Nov. 21	Receives from his father	$ .60
	Church	.25
22	Collects for papers	.57
	Buys luncheon	.25
	Candy	.05
23	From his father	.40
	Buys luncheon	.30
	Picture show	.15
24	From his father	.30
	Gives to fund for poor	.15
	Buys luncheon	.35
	Collects for papers	1.14
25	From his father	.75
	Football game	.50
	Buys candy	.10
26	From his father	.25
	From his grandfather	2.00
	Picture show	.15
	Buys candy	.10
27	From his father	.50
	Collects for papers	2.85
	Pays for papers bought	5.75

(6) Harriet Kennedy received each day from her father and mother money for her luncheon and the inexpensive school supplies.

1920

May 2	From her father	$ .05
	" " mother	.30
	Sunday School	.10
3	From mother	.20

	From father	.10
	Buys luncheon	.24
	Lent Ruth	.02
4	From mother	.20
	Buys luncheon	.15
5	From father	.25
	" mother	.21
	" father	.10
	Buys Thrift Stamp	.25
	Luncheon	.18
	Ice cream	.10
6	From father	.05
	" mother	.32
	Buys pencil	.05
	Luncheon	.22
	Received from Ruth	.02
7	From mother	.20
	Buys luncheon	.18
	From father	.40
8	Picture show	.15
	Car fare	.10

(7) Joseph Lane receives money from his father and mother as he needs it.

1920

Nov. 24	From his father	$ .50
	Buys paper	.07
	Luncheon	.22
25	From mother	.40
	Buys luncheon	.15
	Pencils	.15
26	From mother	1.20
	Buys luncheon	.15
	Manual Training supplies	1.00
	Tablet	.05

27	From father	.50
	Buys luncheon	.15
	Charity	.05
	Buys candy	.05
28	From father	.25
	Buys magazine	.15
	Church	.05
	Buys tablet	.05
29	From mother	.25
	Buys box of candy	.25
30	From mother	6.00
	Buys Christmas present	1.00
	Put in bank	5.00

(8) Harriet Terry receives an allowance of $2 a week from her father for lunches and small school expenses, but for articles of clothing she is given more.

1920

May 5	Allowance	$2.00
	Buys luncheon	.25
6	From brother	.50
	Buys luncheon	.25
7	From mother	1.25
	Buys notebooks	.28
	Luncheon	.20
	Ice cream	.10
8	From father	5.00
	Buys hat	6.50
	Car fare	.10
	Gift for mother	.50
9	Buys pieces of music	.20
	Church	.10

10	From mother	.25
	Buys pencil	.05
	Luncheon	.25
11	From mother	.40
	Buys luncheon	.15
	Picture show	.10

3. Suppose some relative has made you a present of $10, which you are to spend exactly as you please. Make a list of the things you would buy and enter it in the cashbook. Find your balance, if any, as before.

4. (a) Keep a cashbook of your own account for a month.

(b) Be careful to write in the cashbook each day exactly what you have received and what you have spent.

(c) If you do not carry your cashbook with you all the time, it is a good plan to have a small notebook always with you and to make a memorandum of each item immediately upon receiving or spending any money.

(d) Balance your account at the end of the month. Bring down your balance on the cash receipt side, ready for your second month's account.

(e) What per cent of your total receipts is your cash balance?

(f) Can you make it larger next month?

(g) Why is keeping personal accounts a good habit to form?

(h) Does your mother keep a record of her household expenses? If not, ask her to let you do it.

(i) Your thrift depends not upon how much you have to spend, but upon what per cent of it you save. How thrifty are you?

B. DOING BUSINESS ON A CASH BASIS

I. Model—A Month's Business of a Grocer

1. (a) Every successful business man keeps an accurate account of his business day by day and month by month. Let us examine one man's record of a month's business.

This man, E. W. Williams, has $3500 capital, which he decides to invest in the grocery business.

(b) The following memorandum is a record of his first month's business:

1919

May	1	E. W. Williams, investment	$3500.00
		Pays rent	40.00
		Buys merchandise	658.40
		Buys an ice box	150.00
		Buys a meat block	20.00
	2	Buys meat knives	10.00
		Pays for show cases and shelves	600.00
		Buys a desk	35.00
		Makes a deposit for gas	5.00
		Makes a deposit for electricity	5.00
	3	Buys computing scales	225.00
		Buys a coffee grinder	250.00
		Buys a delivery truck	500.00
	5	Buys merchandise	215.75
		Buys a cash register	150.00
		Buys a safe	100.00
	6	Buys merchandise	550.15
		Buys wrapping paper	7.00
	7	Buys merchandise	850.54
		Sales	171.50
	8	Pays for advertising	100.00
		Sales	179.65

9	Buys merchandise	654.50
	Sales	181.00
10	Pays salaries, two clerks	35.00
	Pays butcher's salary	25.00
	Pays delivery boy	15.00
	Pays himself a salary	50.00
	Sales	246.00
12	Sales	139.50
13	Sales	205.25
14	Sales	151.55
15	Sales	163.60
16	Buys merchandise	750.75
	Sales	181.85
17	Sales	381.15
	Pays salaries to two clerks	35.00
	Pays butcher's salary	25.00
	Pays delivery boy	15.00
	Pays himself a salary	50.00
19	Sales	221.29
20	Buys merchandise	470.64
	Sales	208.00
21	Sales	255.68
22	Sales	200.25
23	Sales	186.70
24	Sales	230.91
	Pays salaries, two clerks	35.00
	Pays butcher's salary	25.00
	Pays delivery boy	15.00
	Pays himself a salary	50.00
26	Sales	247.18
	Buys merchandise	335.72
27	Sales	209.14
28	Sales	335.81
29	Sales	271.16

31	Pays salaries, two clerks	35.00
	Pays butcher's salary	25.00
	Pays delivery boy	15.00
	Pays himself a salary	50.00
	Sales	115.00
	Inventory	800.00

2. (a) On which side of the cashbook should *E. W. Williams, Investment* be placed?

(b) Look at the model to see if your decision is correct.

3. (a) Write *Cash Receipts* at the top of the *left-hand* page in your cashbook.

(b) Write *Cash Payments* at the top of the *right-hand* page.

4. (a) Write *3500* in the first money column.

(b) Write *May 1* in the date column on the cash receipt side. In the same space and just above the word *May*, write the year.

(c) Write *E. W. Williams, Investment* on the cash receipt side.

5. (a) On which side of the cashbook should *Rent* be placed?

(b) Look at the model to see if your decision is correct.

6. (a) Write *Rent 40.00* on the cash payment side in the first money column.

(b) On that line write *May 1* in the date column. Between the word *May* and the line above write *1919*.

(c) *Always* write the amount of an item first, then the date, and last the name or description of the item.

7. (a) On which side of the cashbook should the purchase of merchandise go?

(b) Look at the model to see if your decision is correct.

E. W. WILLIAMS,

#20 Cash Receipts

19-9		L F					
May	1	GJ	E W Williams Investment		3 5 2 0 0 0		
	7	-	Sales		1 7 1 5 0		
	8	-	Sales		1 7 9 6 5		
	9	-	Sales		1 8 1 0 0		
	10	-	Sales		2 4 6 0 0		
	12	-	Sales		1 3 9 5 0		
	13	-	Sales		2 0 5 2 5		
	14	-	Sales		1 5 1 5 5		
	15	-	Sales		1 6 3 6 0		
	16	-	Sales		1 8 1 8 5		
	17	-	Sales		3 8 1 1 5		
	19	-	Sales		2 2 1 2 9		
	20	-	Sales		2 0 8 0 0		
	21	-	Sales		2 5 5 6 8		
	22	-	Sales		2 0 0 2 5		
	23	-	Sales		1 8 6 3 0		
	24	-	Sales		2 3 0 9 1		
	26	-	Sales		2 4 7 1 8		
	27	-	Sales		2 0 9 1 4		
	28	-	Sales		3 3 5 8 1		
	29	-	Sales		2 7 1 1 6		
	31	-	Sales		1 1 5 0 0		
			Total Receipts				7 9 8 2 1 7
							7 9 8 2 1 7
19-9 June	2		Balance		1 7 9 8 7 2		

BOOK

GROCER

Cash Payments — #21

1909		L.F.			
May	1	744	Rent	40 00	
			Purchases Mdse	658 40	
		745	Ice Box	150 00	
			Meat Block	20 00	
	2		Meat Knives	10 00	
			Show Cases and Shelves	600 00	
			Desk	35 00	
			Deposit for gas	5 00	
			Deposit for electricity	5 00	
	3		Computing scales	225 00	
			Coffee Grinder	25 00	
			Delivery Truck	500 00	
	5		Purchases Mdse	216 75	
			Cash Register	150 00	
			Safe	100 00	
	6		Purchases Mdse	556 16	
			Supplies Wrapping Paper	7 00	
	7		Purchases Mdse	850 54	
	8		Advertising	10 00	
	9		Purchases Mdse	454 50	
	10		Salary Clerks	35 00	
			Salary Butcher	25 00	
			Delivery Boy	15 00	
			Salary E. W. Williams	50 00	
	16		Purchases Mdse	750 75	
	17		Salary Clerks	35 00	
			Salary Butcher	25 00	
			Delivery Boy	15 00	
			Salary E. W. Williams	50 00	
	20		Purchases Mdse	470 64	
	24		Salary Clerks	35 00	
			Salary Butcher	25 00	
			Delivery Boy	15 00	
			Salary E. W. Williams	50 00	
	26		Purchases Mdse	335 72	
	31		Salary Clerks	35 00	
			Salary Butcher	25 00	
			Delivery Boy	15 00	
			Salary E. W. Williams	50 00	
			Total Payments		7,183 46
			Balance		798 71
				7,982 17	

(c) Write *Purchases, Mdse.....658.40* on the cash payment side of the cashbook. It is not necessary to put in the date since it is the same as for the preceding item.

8. (a) On which side does the purchase of an ice box go?

(b) Look at the model to see if your decision is correct.

(c) On the cash payment side write *Ice box.....150.00*

9. (a) In this same manner decide on which side of the cashbook each item of the memorandum should be placed.

(b) Each time before you enter an item look at the model to see if your decision is correct.

(c) The inventory is not to be entered upon the cashbook. Its use will be explained later.

10. (a) After all the entries are made, draw a line under the column of figures on the cash receipt and also on the cash payment side.

(b) Write *Total Receipts* under the last item on the cash receipt side.

(c) Foot this column and write the footing in the *second* money column. Until you have checked your addition, write the footing lightly in pencil in the first column.

11. In like manner close the cash payment side.

12. Look carefully to see the correct ruling in balancing the cashbook.

13. How do you get the balance of cash on hand?

14. Why should the total payments and balance added together equal the total receipts?

15. (a) Which side extends farther down the page, the cash payment side or the cash receipt side?

(b) What is done to the shorter side to make it even with the longer side, so we may say the account is *in balance,* or *balanced?*

(c) After the account is balanced what kind of ruling is used?

16. On which side of the cashbook, below the double ruling, should the cash balance be placed in order to begin the next month's record?

II. Classifying Accounts — Posting in Ledger

1. (a) A business man likes to know what his sales for a month are in each department of his store; how much he has spent for rent, for purchases, for salaries, and for each different item; that is, he likes to have his accounts classified. To do this, he needs a book other than the cashbook. This book in which he keeps a classified record of his receipts and expenses is called a *ledger*.

(b) Look on page 158 at the ruling of ledger paper. How does it differ from the ruling of the cashbook? Notice that the page is divided into two parts with a date column and a money column in each.

2. Preparing the ledger

(a) On the top of a ledger page write *E. W. Williams, Capital.*

(b) Count four lines below this and in the middle of the fourth line write *Sales.*

(c) How many sales are in the cashbook on the cash receipt side?

(d) In the ledger just under *Sales* count down twenty-one lines.

(e) Then count three lines more to avoid crowding the work and write the word *Rent*, the first item on the cash payment side of the cashbook.

(f) How many different kinds of items are in the cashbook on the *right* or cash payment side?

(g) Four lines below or at the top of the next page of the ledger write *Purchases.*

(h) How many times does the item *Purchases* appear on the right side of the cashbook?

Count twelve lines below *Purchases* or at the top of the next page write *Initial Expense.*

(i) How many items in the cashbook are initial expenses; that is, expenses one has only at the beginning of the business?

Leave fourteen lines below *Initial Expense* for these items.

On the fifteenth line write *Gas.*

(j) How many times does *Gas* appear in the cashbook?

In the middle of the fifth line below *Gas* write *Electric Light.*

(k) In the middle of the fourth or fifth line below *Electric Light* write *Supplies.*

(l) On the fourth or fifth line below *Supplies* write *Advertising.*

(m) On the fourth or fifth line below *Advertising* or on the next page write *Salaries.*

3. Transferring items as classified from the cashbook to the ledger

(a) With all these headings in the ledger, we are now ready to transfer every item from each side of the cashbook to the ledger under the proper heading.

When an item is transferred from the cashbook to the ledger, we say it has been *posted.* The transfer is called *posting.*

(b) Every item on the *left* side of the cashbook is posted on the *right* side of the ledger page.

(c) Every item on the *right* side of the cashbook is posted on the *left* side of the ledger.

(d) (1) What is the first item in the cashbook under *Cash Receipts?*

(2) What is the most important part of that item?

(3) Keep this number *3500* in mind till you find the place in the ledger, where *E. W. Williams, Capital* is written.

(4) In the money column on the *right* side of the page write *3500.*

(5) Now look back at the cashbook to find the date of this entry, and put $\frac{1919}{May\ 1}$ in the date column on the same side of the ledger on which *3500* was written.

(6) From what page of the cashbook was this item taken?

In the ledger, write the number of this page in the column just to the left of *3500* in the money column.

To the left of the page number just outside the column write *C.* This *C* stands for cashbook. With the number, it shows that the item has been posted from a certain page of the cashbook.

(7) On what page of the ledger did you post this item?

In the cashbook there is a column marked *L. F.* in which this ledger page is to be recorded.

L. F. means *ledger folio.*

In the cashbook, just after the date column and in front of *E. W. Williams, Investment,* write the number of this ledger page.

(8) What is the next item on the *left,* or cash receipts, side of the cashbook?

On the *right* side of the ledger under *Sales* write *171.50* first.

June E. W. Williams, Capital

1919										
May	1					C	#26		3	60 00 0
					Sales					
1919										
May	7					C	#26			171 50
	8					C	"			179 65
	9					C	"			181 00
	10					C	"			246 00
	12					C	"			139 50
	13					C	"			200 25
	14					C	"			161 55
	15					C	"			163 60
	16					C	"			181 85
	17					C	"			381 15
	19					C	"			221 29
	20					C	"			209 00
	21					C	"			255 68
	22					C	"			200 25
	23					C	"			186 70
	24					C	"			230 91
	26					C	"			247 18
	27					C	"			209 14
	28					C	"			385 81
	29					C	"			271 16
	31					C	"			115 00
					Rent					
1919										
May	1			C	#21			40 00		
					Purchases					
1919										
May	1			C	#21			658 40		
	3			C	"			215 75		
	6			C	"			550 15		
	7			C	"			850 54		
	9			C	"			654 50		
	16			C	"			760 75		
	20			C	"			470 64		
	26			C	"			338 72		

1919 May	1	C	421	150000	
		C	"	20000	
	2	C	"	10000	
		C	"	600000	
		C	"	35000	
	3	C	"	225000	
		C	"	500000	
		C	"	250000	
	5	C	"	150000	
		C	"	100000	
				Gas	
1919 May	2	C	421	5000	
				Electrical Light	
1919 May	2	C	421	5000	
				Supplies	
1919 May	6	C	421	7000	
				Advertising	
1919 May	8	C	421	100000	

Salary

| 1914 | | |

4. (a) In this same way, post all of the items from the *left* side of the cashbook to the *right* side of the ledger.

(b) Be very careful to post in the right order.

Post the *amount* of each item first,
then the *date*
cashbook page,
and *C*, in the ledger;
and last, the *ledger page* in the cashbook.

To avoid error, this order is the best and is the one used by all bookkeepers.

5. In like manner post all of the items from the *right*, or cash payments, side of the cashbook to the *left* side of the ledger under their proper headings.

III. Checking the Work — Trial Balance

1. (a) After all the items are posted from both sides of the cashbook to the ledger, find the footings of all columns in the ledger.

(b) Write each footing lightly in pencil under its column.

2. (a) At this point it is a good plan to check the work, for above all else a bookkeeper must be accurate.

(b) The best check is to take off a *trial balance.* This is usually taken off at the end of each month.

3. Taking off a Trial Balance

(a) In the model, what kind of ruling is used for the trial balance?

(b) At the top of a similarly ruled page, write *Trial Balance, May 31, 1919.*

(c) On the first line write
E. W. Williams, Capital.

(d) In the *second*, or right-hand money column, write *3500.*

From which side of the ledger is the *3500* taken?

(e) On the next line write *Sales*, and under the *3500* place *4482.17*.

(f) On the third line, write *Rent* and place *40* in the *first*, or left-hand, money column.

(g) We see that an item on the *left* side of the ledger is placed in the *left* money column of the trial balance and one from the *right* side of the ledger is placed in the *right* money column.

(h) Transfer all totals from the ledger to the trial balance sheet.

(i) On the next line write *Cash*.

(j) From the cashbook, find how much cash there is on hand and write this amount in the first money column.

(k) Draw a line and add both money columns.

(l) Why does the cash on hand added to the left money column make the two footings equal?

(m) If there is no error in the work up to this point, these footings will exactly balance each other.

(n) Before proceeding further, see that these are in balance. If not, go over your work and find your error.

(o) Draw the double lines at the end of your trial balance as shown in the model.

Trial Balance, May 31, 1919

	E. W. Williams, Capital			3500	00
	Sales			4482	17
	Rent	40	00		
	Purchases	4486	45		
	Initial Expense	2040	00		
	Gas	5	00		
	Electric Light	5	00		
	Supplies	7	00		
	Advertising	100	00		
	Salary	500	00		
	Cash	798	72		
		7982	17	7982	17

IV. Finding the Result of the Month's Business

1. (a) If there is no error in the work as shown in the trial balance, a summary of the month's business may be made.

This summary is called the *profit and loss statement* and is made from the trial balance.

(b) Before the grocer can make a profit and loss statement, he needs to know how much stock he has left on his shelves. Not all of the goods purchased in May have been sold, but part of the stock is left over to start with in June. A list of all such stock on hand is an *inventory.* The cost of the goods sold in May is evidently the difference between the amount of all his purchases and the inventory. In this account the inventory is given as $800, as there is no way of finding it from the problem.

2. Making the Profit and Loss Statement

(a) As a heading write:

Profit and Loss Statement
May 1 to May 31, 1919

(b) On the first line below write *Total Sales,* and place *4482.17* in the second money column.

(c) Under this, write *Purchases* and place *4486.45* in the first money column.

(d) From the purchases subtract the inventory, to find the cost of goods sold. In which money column is this item placed?

(e) Subtract the cost of goods sold from the *Total Sales.* This remainder is the *gross profits.* What is the meaning of the term *gross profits?*

(f) Leave a blank line and on the next one write *Expenses.*

(g) Under this, copy from the trial balance sheet the totals of all expenses except *Initial Expense*, writing their amounts in the *first* money column. Initial expenses are not counted in the profit and loss statement, for they are a permanent investment, not running expenses.

(h) Find the grand total expenses and write the sum in the *second* money column.

(i) Subtract the total expenses from the gross profits. This remainder is the *net profits*.

3. A business man measures the success of his business by certain per cents.

(a) The net profit is what per cent of the total sales?

(b) Estimate and then calculate exactly.

(c) The total expenses are what per cent of the total sales?

Profit and Loss Statement

May 1 to May 31, 1919

Total Sales			4482	17
Purchases	4486	45		
Inventory, May 31	800	00		
Cost of Goods Sold			3686	45
Gross Profits			795	72
Expenses				
Rent	40	00		
Gas	5	00		
Electric Light	5	00		
Supplies	7	00		
Advertising	100	00		
Salary	500	00		
Total Expense			657	00
Net Profit			138	72

V. Problem — Next Month's Business of the Grocer

1. The following is a memorandum of the next month's business of this grocer:

1919			
June	2	Balance on hand	$ 798.72
		Rent	40.00
		Sales	116.50
	3	Purchases	825.50
		Sales	150.65
	4	Sales	230.19
	5	Telephones for 3 mos.	37.50
		Sales	120.60
	6	Sales	175.50
	7	Sales	160.17
		Salaries, clerks	35.00
		Salary, butcher	25.00
		Paid to delivery boy	15.00
		Salary, E. W. Williams	50.00
	9	Sales	242.70
	10	Sales	186.80
		Electric Light	3.00
	11	Sales	165.84
	12	Sales	160.40
		Advertising	25.00
		Purchases, Mdse.	660.65
	13	Sales	192.37
	14	Sales	216.10
		Salaries, clerks	35.00
		Salary, butcher	25.00
		Paid to delivery boy	15.00
		Salary, E. W. Williams	50.00
	16	Sales	232.70
		Purchases, Mdse.	550.72
	17	Sales	220.15
	18	Sales	165.70
	19	Sales	215.75
		Purchases, Mdse.	428.16
	20	Sales	196.18

June 21	Sales	212.50
	Salaries, clerks	35.00
	Salary, butcher	25.00
	Paid to delivery boy	15.00
	Salary, E. W. Williams	50.00
23	Sales	165.17
	Purchases, Mdse.	879.63
24	Sales	156.30
25	Sales	188.47
	Advertising	25.00
26	Sales	210.75
	Purchases, Mdse.	690.18
27	Sales	176.52
	Purchases, supplies	17.27
28	Sales	205.25
	Salaries, clerks	35.00
	Salary, butcher	25.00
	Paid to delivery boy	15.00
	Salary, E. W. Williams	50.00
30	Sales	176.35
	Inventory	1036.33

2. (a) Put these transactions in the cashbook.

(b) Balance the cashbook.

(c) Post in the ledger.

(d) Take off a trial balance.

Notice that the initial expenses must be included in this trial balance as well as in that of the first month. Why?

(e) Make a profit and loss statement.

(f) Find what per cent of the total sales his total expenses are.

(g) What per cent of the total sales is his net profit?

(h) Since the trial balance and the profit and loss statement for the second month's business are slightly different, the models for these are given.

Use them as a check upon your work.

Trial Balance, June 30, 1919

E. W. Williams, Capital				3638	72
Sales				4639	61
Inventory, May 31, 1919	800	00			
Purchases	4034	84			
Initial Expenses, May, 1919	2040	00			
Rent	40	00			
Telephones	37	50			
Electric Light	3	00			
Supplies	17	27			
Advertising	50	00			
Salary	500	00			
Cash	755	72			
	8278	33		8278	33

Profit and Loss Statement
June 1 to June 30, 1919

Total Sales			4639	61
Inventory, May 31, 1919	800	00		
Purchases	4034	84		
	4834	84		
Inventory, June 30, 1919	1036	33		
Cost of Goods Sold			3798	51
Gross Profit			841	10
Expenses				
Rent	40	00		
Telephones	37	50		
Electric Light	3	00		
Supplies	17	27		
Advertising	50	00		
Salary	500	00		
Total Expense			647	77
Net Profit			193	33

C. DOING BUSINESS ON CASH AND CREDIT BASIS

I. Model—A Month's Business of a Milliner

Thus far all of our accounts have been on a cash basis. But most of the business of the world is done partly on a credit basis.

1. The following account of a milliner shows the slight changes necessary in keeping the records of a business done partly on credit.

A business girl, Margaret Morton, has been saving money until she has $2000. On March 1, 1919, she opens a millinery shop. The following are her transactions for a month:

1919

Mar.	1	Paid one month's rent in cash	$200.00
		Paid by check Mitchell & Co. for fixtures..	540.00
		(Write the check and indorse it.)	
	3	Paid for telephones for 3 months	37.50
		Bought of Smith & Co., Cleveland, wrapping material, boxes, etc.	48.50
	4	Bought of McMinn Bros., frames, linings.	125.00
		Bought of L. C. Cater Co., Local, trimmings, etc.	950.00
	5	Sold to Mrs. A. C. Barker, on acct.	
		1 Hat 18.00	
		1 Veil ..... .50	
		Sold to Mrs. S. L. Bates on acct.	
		3 Hats @ 6.50	
		Cash Sales	20.00
	6	Cash Sales	5.00
		Sold to Mrs. L. C. Beard, on acct.	
		3 Hats 50.00	
		(20.00, 15.00, 15.00)	
		1 Hat retrimmed 2.50	
		Sold to Mrs. A. H. Reeves, on acct.	
		2 Hats 40.00	

	Hat cleaned	1.00	
	Trimmings	4.00	
	Sold to Mrs. S. K. Bailey on acct.		
	1 Hat	40.00	
Mar. 7	Cash Sales		100.00
	Sold to Mrs. J. M. Marks on acct.		
	1 Hat	10.00	
	Sold to Mrs. L. A. Moore on acct.		
	3 Hats @	10.00	
	1 Hat	15.00	
	1 Hat	20.00	
	Sold to Miss Mary C. James, on acct.		
	1 Hat	7.00	
8	Cash Sales		22.00
	Salary to Trimmer		25.00
	Salaries, 3 Makers @ 12.50		37.50
	Salaries, 2 Saleswomen @ 15.00		30.00
	Salary, Margaret Morton		25.00
	Salary, Bookkeeper		10.00
	Paid to delivery boy		5.00
	Paid Smith & Co. by check bill of Mar. 3		48.50
	(Write the check and indorse it.)		
10	Paid McMinn Bros. bill of Mar. 4		125.00
	Cash sales		50.00
	Received Mrs. S. L. Bates, bill of Mar. 5		19.50
11	Cash Sales		5.00
12	Cash Sales		15.00
13	Sold to Miss A. F. Shaw, on acct.		
	1 Hat	12.50	
	Sold to Mrs. E. K. Peer, on acct.		
	1 Hat	16.50	
	Sold to Miss F. J. Myers, on acct.		
	1 Hat	8.00	
	Sold to Mrs. P. J. Lawson, on acct.		
	1 Hat	10.00	

Mar.	14	Cash Sales	21.40
		Sold to Miss L. C. Lannon, on acct.	
		1 Hat 25.00	
		Sold to Mrs. J. V. Kames, on acct.	
		2 Hats @ 12.50	
	15	Cash Sales	52.48
		Received Mrs. L. C. Beard, bill Mar. 6	52.50
		Salary, Trimmer	25.00
		Salaries, 3 Makers @ 12.50	37.50
		Salaries, 2 Saleswomen @ 15.00	30.00
		Salary, Margaret Morton	25.00
		Salary, Bookkeeper	10.00
		Paid to delivery boy	5.00
		Received Mrs. A. C. Barker, bill Mar. 5	18.50
	17	Sold to Miss A. R. Johnson, on acct.	
		2 Hats @ 10.00	
		Sold to Mrs. P. L. James, on acct.	
		3 Hats @ 5.00	
		1 Hat 15.00	
		Received Mrs. A. H. Reeves, bill Mar. 6	45.00
		Paid L. C. Cater, bill Mar. 4	950.00
	18	Cash sales	95.00
		Mrs. S. K. Bailey, bill of Mar. 6	40.00
	19	Cash Sales	75.00
		Mrs. J. M. Marks, bill of Mar. 7	10.00
	20	Sold to Mrs. B. F. Allen, on acct.	
		1 Hat 10.00	
		3 Hats @ 7.50	
		Sold to Miss L. K. Alexander, on acct.	
		1 Hat 22.50	
		1 Veil 1.00	
		Sold to Mrs. A. D. Smith, on acct.	
		1 Hat 28.00	
		2 Hats @ 6.50	

	Sold to Mrs. J. M. Dooly, on acct.	
	1 Hat 20.00	
	2 Hats @ 8.75	
	1 Hat 10.00	
Mar. 21	Cash Sales	51.50
	Sold to Mrs. J. D. Dales, on acct.	
	1 Hat 15.00	
	4 Hats @ 8.00	
	Sold to Mrs. B. L. Duncan, on acct.	
	5 Hats @ 7.50	
22	Cash Sales	165.60
	Sold to Miss C. A. Beck, on acct.	
	1 Hat 6.50	
	1 Hat 12.00	
	Mrs. B. F. Allen paid on bill of Mar. 20 ..	15.00
	Bought of McMinn Bros. trimmings	50.00
	Mrs. J. V. Kames, paid on bill of Mar. 14	10.00
	Sold to Mrs. L. C. Porter, on acct.	
	1 Hat 7.00	
	1 Hat 15.00	
	Mrs. E. K. Peer, bill of Mar. 13	16.50
	Salary, Trimmer	25.00
	Salaries, 3 Makers @ 12.50	37.50
	Salaries, 2 Saleswomen @ 15.00	30.00
	Salary, Margaret Morton	25.00
	Salary, Bookkeeper	10.00
	Paid to delivery boy	5.00
	Paid for advertising	25.00
24	Mrs. L. A. Moore, bill of Mar. 7	65.00
	Cash Sales	150.00
	Mrs. P. L. James, bill of Mar. 17	30.00
	Cash Sales	82.40
	Miss F. J. Myers, bill of Mar. 13	8.00
26	Cash Sales	48.60
	Sold to Miss A. L. Burton, on acct.	
	1 Hat 20.00	

	Mrs. P. J. Lawson, bill of Mar. 13.....	10.00
	Sold to Mrs. C. M. Mooney, on acct.	
	1 Hat..... 25.00	
Mar. 27	Miss Mary C. James, bill of Mar. 7.....	7.00
	Cash Sales.....	10.00
28	Sold to Mrs. J. C. Cotes, on acct.	
	2 Hats @..... 8.75	
	1 Hat..... 20.00	
	Miss L. C. Lannon, bill of Mar. 14.....	25.00
	Sold to Mrs. A. E. Jameson, on acct.	
	1 Hat..... 15.00	
	2 Hats @ 5.00	
	Miss A. F. Shaw, bill of Mar. 13.....	12.50
29	Sold to Mrs. B. O. Deeds, on acct.	
	3 Hats @..... 4.50	
	1 Hat..... 10.00	
	Mrs. J. V. Kames, bill of Mar. 14 in full .	15.00
	Sold to Mrs. C. F. Penn, on acct.	
	1 Hat..... 22.00	
	1 Hat..... 27.00	
	Paid McMinn Bros. on acct.....	20.00
	Sold to Mrs. C. L. Page, on acct.	
	2 Hats @..... 3.50	
	1 Hat..... 12.50	
	1 Hat..... 5.00	
	Mrs. B. F. Allen, paid in full bill of Mar. 20	17.50
	Salary, Trimmer.....	25.00
	Salaries, 3 Makers @ 12.50.....	37.50
	Salaries, 2 Saleswomen @ 15.00.....	30.00
	Salary, Margaret Morton.....	25.00
	Salary, Bookkeeper.....	10.00
	Paid to delivery boy.....	5.00
31	Miss A. R. Johnson, bill of Mar. 17.....	20.00
	Cash Sales.....	75.00
	Sold to Mrs. B. L. Moore, on acct.	

1 Hat	25.00
1 Hat	18.00
1 Hat retrimmed	4.00
Inventory	350.75

2. (a) In doing business on the credit basis, besides using the cashbook, the bookkeeper uses another book for the purchases on credit. This book is called a *purchase book.*

(b) A third book is used for the sales on credit. This book is called a *sales book.*

(c) Instead of using a sales book, some firms use a card system, in which there is a card for each customer who buys on credit. The record on these cards is really in ledger form.

3. (a) Enter each transaction of Miss Morton's business for the month of March in the book where it belongs, using the cashbook, purchase book, and sales book.

(b) Notice that it has already been done in your text, but this record is to be used only in checking your work. Before looking at the model, decide in which book you should make the entry. Then look to see if you are right. If you differ from the model as to the place of entry, think about it again to see which is correct. Be sure you know why each item is placed where it is. If necessary, consult your teacher.

(c) After all the entries are made for the month, balance and rule the cash book. Bring the cash balance down below the ruling.

(d) Foot and rule the purchase book and sales book.

(e) Enter the accounts in the ledger, referring to the model whenever there is doubt about your decision.

(f) Look at the account of Smith & Co. in the ledger. This shows that the goods purchased on March 3 were paid for on March 8. The purchase is posted on the right side and the payment on the left side of the ledger page. To show that this account is closed, draw a line under the amount on each side of the page as shown. These items are in balance and do not need to be considered in making the trial balance.

(g) Look at the second account, that of McMinn Bros. Notice that the first items are in balance and are ruled to show it. The second ones are not, as only $20 was paid on a bill of $50, which leaves a balance owed of $30. Only accounts in balance are ruled. In the same way rule all accounts which are in balance.

(h) Find the totals of all the different accounts in the ledger, as you will need these in your trial balance.

Put the footings lightly in pencil under each account.

(i) Take off a trial balance. Do this in pencil on tablet paper without referring to the model.

After it is done, check your work by the model, just as you check a problem by referring to an answer book.

(1) Why is $30 which the milliner still owes McMinn Bros. put in the same column with Capital and Sales?

Until this debt is paid, in whose possession is that money?

(2) Find the total of all accounts still due the milliner, and list the total as *Accounts Receivable.*

In which column should such unpaid bills be placed?

(3) Why does $1004.98, the cash on hand, added to the left-hand column make it balance with the right-hand column?

(j) (1) Make a profit and loss statement.

(2) Not all the goods purchased in March have been sold, but part is left over to start with in April. What name is given to a list of stock on hand?

In this account the *inventory* is given as $350.75, as there is no way of finding it from the problem.

(3) In practice, most business houses keep such exact records of all articles bought and sold that the amount on hand at the end of the month can readily be found without the arduous task of taking stock.

(4) At least once a year, usually in February, the inventory is made by actually taking stock. Why are January sales sometimes called Pre-Inventory Sales?

(5) From Purchases and Inventory, how can you find the Cost of Goods Sold?

(6) From the Total Sales and Cost of Goods Sold, how can you find the gross profit?

(7) What is the meaning of *Gross Profit?*

(8) Find the Total Expenses.

(9) From the Gross Profit and the Total Expenses, how can you find the Net Profit?

(10) What is the meaning of *Net Profit?*

(11) In round numbers this net profit is $350. Estimate the per cent this gain is on the capital invested.

(12) Use the exact net profit and calculate the per cent of gain.

(13) Why is it necessary for a milliner to make such a large profit during a spring month?

Cash Book

Cash Receipts

	L. F.					
1919						
Mar. 1	182	Margaret Morton, Investment	2000	00		
5	182	Sales	20	00		
6	182	Sales	5	00		
7	182	Sales	100	00		
8	182	Sales	22	00		
10	182	Sales	50	00		
	184	Mrs. S. L. Bates, Bill, Mar. 5	19	50		
11	182	Sales	5	00		
12	182	Sales	15	00		
14	182	Sales	21	40		
15	182	Sales	52	48		
	184	Mrs. L. C. Beard, Bill, Mar. 6	52	50		
	183	Mrs. A. C. Barker, Bill, Mar. 5	18	50		
17	184	Mrs. A. H. Reeves, Bill, Mar. 6	45	00		
18	182	Sales	95	00		
	184	Mrs. S. K. Bailey, Bill, Mar. 6	40	00		
19	182	Sales	75	00		
	184	Mrs. J. M. Marks, Bill, Mar. 7	10	00		
21	182	Sales	51	50		
22	182	Sales	165	60		
	185	Mrs. B. F. Allen, On Bill, Mar. 20	15	00		
	185	Mrs. J. V. Kames, On Bill, Mar. 14	10	00		
	184	Mrs. E. K. Peer, Bill, Mar. 13	16	50		
24	184	Mrs. L. A. Moore, Bill, Mar. 7	65	00		
	182	Sales	150	00		
	185	Mrs. P. L. James, Bill, Mar. 17	30	00		
25	182	Sales	82	40		
	184	Miss F. J. Myers, Bill, Mar. 13	8	00		
26	182	Sales	48	60		
	184	Mrs. P. J. Lawson, Bill, Mar. 13	10	00		
27	184	Miss Mary C. James, Bill, Mar. 7	7	00		
	182	Sales	10	00		
28	185	Miss L. C. Lannon, Bill, Mar. 14	25	00		
	184	Miss A. F. Shaw, Bill, Mar. 13	12	50		
29	185	Mrs. J. V. Kames, Bill, Mar. 14, in full	15	00		
	185	Mrs. B. F. Allen, Bill, Mar. 20, in full	17	50		
31	185	Miss A. R. Johnson, Bill, Mar. 17	20	00		
	182	Sales	75	00		
		Total Receipts			3480	98
Apr. 1		Balance	1004	98		

Cash Payments

	L. F.			
1919				
Mar. 1	182	Rent	200 00	
	182	Fixtures	540 00	
3	182	Telephones (3 mo.)	37 50	
8	183	Salary, Trimmer	25 00	
	183	Salaries, 3 Makers @ 12.50	37 50	
	183	Salaries, 2 Saleswomen @ 15.00	30 00	
	183	Salary, Margaret Morton	25 00	
	183	Salary, Bookkeeper	10 00	
	183	Paid to Delivery Boy	5 00	
	183	Smith & Co., Bill, Mar. 3	48 50	
10	183	McMinn Bros., Bill, Mar. 4	125 00	
15	183	Salary, Trimmer	25 00	
	183	Salaries, 3 Makers @ 12.50	37 50	
	183	Salaries, 2 Saleswomen @ 15.00	30 00	
	183	Salary, Margaret Morton	25 00	
	183	Salary, Bookkeeper	10 00	
	183	Paid to Delivery Boy	5 00	
17	183	L. C. Cater Co., Bill, Mar. 4	950 00	
22	183	Salary, Trimmer	25 00	
	183	Salaries, 3 Makers @ 12.50	37 50	
	183	Salaries, 2 Saleswomen @ 15.00	30 00	
	183	Salary, Margaret Morton	25 00	
	183	Salary, Bookkeeper	10 00	
	183	Paid to Delivery Boy	5 00	
	182	Advertising	25 00	
29	183	McMinn Bros. On acct. bill, Mar. 22	20 00	
	183	Salary, Trimmer	25 00	
	183	Salaries, 3 Makers @ 12.50	37 50	
	183	Salaries, 2 Saleswomen @ 15.00	30 00	
	183	Salary, Margaret Morton	25 00	
	183	Salary, Bookkeeper	10 00	
	183	Paid to Delivery Boy	5 00	
		Total Payments		2476 00
		Balance		1004 98
				3480 98

Sales Book

L. F.					
	March 5, 1919				
183	Mrs. A. C. Barker				
	1 Hat	18	00		
	1 Veil		50		
				18	50
	5				
184	Mrs. S. L. Bates				
	3 Hats @ 6.50			19	50
	6				
184	Mrs. L. C. Beard				
	1 Hat	20	00		
	2 Hats @ 15.00	30	00		
	1 Hat retrimmed	2	50		
				52	50
	6				
184	Mrs. A. H. Reeves				
	2 Hats @ 20.00	40	00		
	Hat cleaned	1	00		
	Trimmings	4	00		
				45	00
	6				
184	Mrs. S. K. Bailey				
	1 Hat			40	00
	7				
184	Mrs. J. M. Marks				
	1 Hat			10	00
	7				
184	Mrs. L. A. Moore				
	3 Hats @ 10.00	30	00		
	1 Hat	15	00		
	1 Hat	20	00		
				65	00
	7				
184	Miss Mary C. James				
	1 Hat			7	00
	13				
184	Miss A. F. Shaw				
	1 Hat			12	50
	Forwarded			270	00

March 13, 1919

L. F.				
	Brought Forward			270 00
184	Mrs. E. K. Peer			
	1 Hat			16 50
	13			
184	Miss F. J. Myers			
	1 Hat			8 00
	13			
184	Mrs. P. J. Lawson			
	1 Hat			10 00
	14			
185	Miss L. C. Lannon			
	1 Hat			25 00
	14			
185	Mrs. J. V. Kames			
	2 Hats @ 12.50			25 00
	17			
185	Miss A. R. Johnson			
	2 Hats @ 10.00			20 00
	17			
185	Mrs. P. L. James			
	3 Hats @ 5.00	15	00	
	1 Hat	15	00	
				30 00
	20			
185	Mrs. B. F. Allen			
	1 Hat	10	00	
	3 Hats @ 7.50	22	50	
				32 50
	20			
185	Miss L. K. Alexander			
	1 Hat	22	50	
	1 Veil	1	00	
				23 50
	20			
185	Mrs. A. D. Smith			
	1 Hat	28	00	
	2 Hats @ 6.50	13	00	
				41 00
	Forwarded			501 50

March 20, 1919

L F.				
	Brought Forward			501 50
185	Mrs. J. M. Dooly			
	1 Hat	20 00		
	2 Hats @ 8.75	17 50		
	1 Hat	10 00		
				47 50
	21			
185	Mrs. J. D. Dales			
	1 Hat	15 00		
	4 Hats @ 8.00	32 00		
				47 00
	21			
185	Mrs. B. L. Duncan			
	5 Hats @ 7.50			37 50
	22			
185	Miss C. A. Beck			
	1 Hat	6 50		
	1 Hat	12 00		
				18 50
	22			
186	Mrs. L. C. Porter			
	1 Hat	7 00		
	1 Hat	15 00		
				22 00
	26			
186	Miss A. L. Burton			
	1 Hat			20 00
	26			
186	Mrs. C. M. Mooney			
	1 Hat			25 00
	28			
186	Mrs. J. C. Cotes			
	2 Hats @ 8.75	17 50		
	1 Hat	20 00		
				37 50
	28			
186	Mrs. A. E. Jameson			
	1 Hat	15 00		
	2 Hats @ 5.00	10 00		
				25 00
	Forwarded			781 50

March 29, 1919

L. F.					
	Brought Forward			781	50
186	Mrs. B. O. Deeds				
	3 Hats @ 4.50	13	50		
	1 Hat	10	00		
				23	50
	29				
186	Mrs. C. F. Penn				
	1 Hat	22	00		
	1 Hat	27	00		
				49	00
	29				
186	Mrs. C. L. Page				
	2 Hats @ 3.50	7	00		
	1 Hat	12	50		
	1 Hat	5	00		
				24	50
	31				
186	Mrs. B. L. Moore				
	1 Hat	25	00		
	1 Hat	18	00		
	1 Hat retrimmed	4	00		
				47	00
181	Total Sales			925	50

Purchase Book

		L. F.				
1919						
Mar.	3	183	Smith & Co. Cleveland, Ohio	48 50		
	4	183	McMinn Bros., Dayton, Ohio	125 00		
		183	L. C. Cater Co., Local	950 00		
	22	183	McMinn Bros., Dayton, Ohio	50 00		
					1173	50

Ledger

Margaret Morton, Capital

							1919						
							Mar.	1		C	176	2000	00
						Sa	les						
							1919						
							Mar.	5		C	176	20	00
								6		C	176	5	00
								7		C	176	100	00
								8		C	176	22	00
								10		C	176	50	00
								11		C	176	5	00
								12		C	176	15	00
								14		C	176	21	40
								15		C	176	52	48
								18		C	176	95	00
								19		C	176	75	00
								21		C	176	51	50
								22		C	176	165	60
								24		C	176	150	00
								25		C	176	82	40
								26		C	176	48	60
								27		C	176	10	00
								31		C	176	75	00
								31		S. B.	181	925	50
												1969	48
						Pur	ch	ases					
1919													
Mar.	4		P. B.	181	1173	50							
						R	ent						
1919													
Mar.	1		C	177	200	00							
						Fi	xt	ures					
1919													
Mar.	1		C	177	540	00							
						Adv	er	tisin	g				
1919													
Mar.	22		C	177	25	00							
						Tel	ep	hone	s				
1919													
Mar.	3		C	177	37	50							

Delivery Expense

1919													
Mar.	8		C	177	5	00							
	15		C	177	5	00							
	22		C	177	5	00							
	29		C	177	5	00							
					20	00							
					Sa	la	ries						
1919													
Mar.	8		C	177	25	00							
			C	177	37	50							
			C	177	30	00							
			C	177	25	00							
			C	177	10	00							
	15		C	177	25	00							
			C	177	37	50							
			C	177	30	00							
			C	177	25	00							
			C	177	10	00							
	22		C	177	25	00							
			C	177	37	50							
			C	177	30	00							
			C	177	25	00							
			C	177	10	00							
	29		C	177	25	00							
			C	177	37	50							
			C	177	30	00							
			C	177	25	00							
			C	177	10	00							
					510	00							
					Smi	th	& C	o.					
1919							1919						
Mar.	8		C	177	48	50	Mar.	3		P. B.	181	48	50
			M		cMi	nn	Bro	s.					
1919							1919						
Mar.	10		C	177	125	00	Mar.	4		P. B.	181	125	00
	29		C	177	20	00		22		P. B.	181	50	00
			L.		C. C	at	er C	o.					
1919							1919						
Mar.	17		C	177	950	00	Mar.	4		P. B.	181	950	00
			M		rs.	A.	C. B	ar	ker				
1919							1919						
Mar.	5	S. B.		178	18	50	Mar.	15		C	176	18	50

Mrs. S. L. Bates

1919 Mar.	5		S. B.	184	19	50	1919 Mar.	10			C	176	19	50
			M	rs.	L.		C. B	ea	rd					
1919 Mar.	6		S. B.	178	52	50	1919 Mar.	15			C	176	52	50
			M	rs.	A.		H. R	ee	ves					
1919 Mar.	6		S. B.	178	45	00	1919 Mar.	17			C	176	45	00
			M	rs.	S.		K. B	ai	ley					
1919 Mar.	6		S. B.	178	40	00	1919 Mar.	18			C	176	40	00
			M	rs.	J.		M.	M	arks					
1919 Mar.	7		S. B.	178	10	00	1919 Mar.	19			C	176	10	00
			M	rs.	L.		A.	M	oore					
1919 Mar.	7		S. B.	178	65	00	1919 Mar.	24			C	176	65	00
			M	iss	M		ary	C.	James					
1919 Mar.	7		S. B.	178	7	00	1919 Mar.	27			C	176	7	00
			M	iss	A.		F. S	ha	w					
1919 Mar.	13		S. B.	178	12	50	1919 Mar.	28			C	176	12	50
			M	rs.	E.		K. P	ee	r					
1919 Mar.	13		S. B.	179	16	50	1919 Mar.	22			C	176	16	50
			M	iss	F.		J. M	ye	rs					
1919 Mar.	13		S. B.	179	8	00	1919 Mar.	25			C	176	8	00
			M	rs.	P.		J. L	a	wson					
1919 Mar.	13		S. B.	179	10	00	1919 Mar.	26			C	176	10	00

Miss L. C. Lannon

1919								1919							
Mar.	14	S. B.	179	25	00			Mar.	28			C	176	25	00
				Mrs. J. V. K				a	mes						
1919								1919							
Mar.	14	S. B.	179	25	00			Mar.	22			C	176	10	00
									29			C	176	15	00
			M	iss	A.			R. J	oh	nson					
1919								1919							
Mar.	17	S. B.	179	20	00			Mar.	31			C	176	20	00
				Mrs. P.				L. J	a	mes					
1919								1919							
Mar.	17	S. B.	179	30	00			Mar.	24			C	176	30	00
				Mrs. B.				F. Al	le	n					
1919								1919							
Mar.	20	S. B.	179	32	50			Mar.	22			C	176	15	00
									29			C	176	17	50
			M	iss	L.			K. A	le	xander					
1919															
Mar.	20	S. B.	179	23	50										
			M	rs.	A.			D. S	mi	th					
1919															
Mar.	20	S. B.	179	41	00										
			M	rs.	J.			M.	D	ooly					
1919															
Mar.	20	S. B.	180	47	50										
			M	rs.	J.			D.	D	ales					
1919															
Mar.	21	S. B.	180	47	00										
			M	rs.	B.			L. D	un	can					
1919															
Mar.	21	S. B.	180	37	50										
			M	iss	C.			A. B	ec	k					
1919															
Mar.	22	S. B.	180	18	50										

Mrs. L. C. Porter

| | | |

Trial Balance, March 31, 1919

Margaret Morton, Capital			2000	00
Sales			1969	48
Purchases	1173	50		
Salaries	510	00		
Rent	200	00		
Fixtures	540	00		
Advertising	25	00		
Telephones	37	50		
Delivery Expense	20	00		
McMinn Bros.			30	00
Accounts Receivable	488	50		
Cash	1004	98		
	3999	48	3999	48

Profit and Loss Statement

March 1 to March 31, 1919

Sales			1969	48
Purchases	1173	50		
Inventory, Mar. 31, 1919	350	75		
Cost of Goods Sold			822	75
Gross Profit			1146	73
Expense				
Salaries	510	00		
Rent	200	00		
Advertising	25	00		
Delivery Expense	20	00		
Telephones	37	50		
Total Expense			792	50
Net Profit			354	23

II. Record of a Month's Business of Another Milliner

1. (a) The following are Jeanne Gray's transactions for a month. Enter each one in the book to which it belongs.

(b) Post to the ledger.

(c) Take off a trial balance.

(d) Make a profit and loss statement.

(e) The net gain is what per cent of capital invested at the beginning of the month?

(f) How does this gain compare with that of Margaret Morton in the preceding problem?

(g) Memorandum:

1919			
April	1	Capital	$2430.45
		Paid rent	200.00
		Cash Sales	25.00
		Sold to Mrs. R. A. Peele, on acct.	
		1 Hat 15.00	
		2 Hats @ 7.50	
		Sold to Miss L. K. Johnson, on acct.	
		1 Hat 22.50	
		1 Hat retrimmed 7.00	
	2	Cash Sales	40.00
		Sold to Mrs. J. M. Green, on acct.	
		2 Hats @ 6.95	
		1 Hat 12.50	
		Sold to Mrs. L. T. Jones, on acct.	
		1 Hat 17.50	
	3	Bought fixtures	540.00
		Cash Sales	35.50
		Sold to Mrs. T. R. Perry, on acct.	
		1 Hat 16.50	
		1 Hat 8.50	
		Sold to Miss R. F. Davis, on acct.	
		1 Hat 12.50	
		Paid for advertising	50.00
	4	Sold to Mrs. H. P. Teems, on acct.	
		1 Hat 20.00	
		1 Hat 15.00	
		Sold to Miss B. A. Lambert, on acct.	
		1 Hat 25.00	
		1 Veil .75	
		Cash Sales	47.00

5	Cash Sales	100.00
	Salary, Trimmer	25.00
	Salaries, 3 Makers @ 12.50	37.50
	Salaries, 2 Saleswomen @ 15.00	30.00
	Salary, Jeanne Gray	25.00
	Salary, Bookkeeper	10.00
	Paid to delivery boy	5.00
	Purchases, trimmings	26.50
7	Cash Sales	107.50
	Bought of C. M. Gregory, Mdse	840.60
8	Cash Sales	208.00
9	Sold to Miss Mary Adams, on acct.	
	1 Hat 18.50	
	Sold to Miss Elizabeth Adams, on acct.	
	1 Hat 20.00	
	Sold to Miss Margaret Adams, on acct.	
	1 Hat 27.50	
	Cash Sales	107.00
10	Sold to Mrs. S. F. Percy, on acct.	
	1 Hat 22.50	
	3 Hats @ 7.50	
	Sold to Mrs. L. C. Casey, on acct.	
	4 Hats @ 5.00	
	1 Hat 12.50	
	Sold to Miss Sarah Vales, on acct.	
	1 Hat 27.00	
	Mrs. H. P. Teems paid bill of Apr. 4	35.00
	Mrs. L. T. Jones paid bill of Apr. 2	17.50
	Cash Sales	23.50
11	Cash Sales	268.00
12	Miss L. K. Johnson paid bill of Apr. 1	29.50
	Cash Sales	65.00
	Sold to Miss Elsie Raye, on acct.	
	1 Hat 15.00	

	Sold to Miss Katherine Raye, on acct.	
	1 Hat 17.50	
	Sold to Miss Louise Bates, on acct.	
	1 Hat 22.50	
	Salary, Trimmer	25.00
	Salaries, 3 Makers @ 12.50	37.50
	Salaries, 2 Saleswomen @ 15.00	30.00
	Salary, Jeanne Gray	25.00
	Salary, Bookkeeper	10.00
	Paid to delivery boy	5.00
14	Paid C. M. Gregory bill of Apr. 7	840.60
	Sold to Mrs. J. F. Cone, on acct.	
	1 Hat 30.00	
	1 Hat 18.50	
	Sold to Miss Mary Grace, on acct.	
	1 Hat 8.50	
	1 Hat retrimmed 4.50	
	Cash Sales	45.00
15	Cash Sales	90.00
	Sold to Miss Jane Bell, on acct.	
	1 Hat 18.50	
	Advertising	100.00
	Mrs. J. M. Green paid bill of Apr. 2	26.40
	Miss Sarah Vales paid bill of Apr. 10 ...	27.00
16	Cash Sales	12.50
	Sold to Mrs. J. M. Bart, on acct.	
	1 Hat 15.00	
	1 Hat 7.00	
	Bought of Lawrence & Company, Mdse..	225.40
17	Cash Sales	100.00
	Miss Margaret Adams paid bill of Apr. 9.	27.50
	Bought of J. F. Anderson, pattern hats..	500.00
18	Sold to Miss Mary Simpson, on acct.	
	1 Hat 20.00	

	Sold to Miss Louise Simpson, on acct.	
	1 Hat 22.50	
	1 Hat cleaned 2.50	
19	Cash Sales	150.00
	Salary Trimmer	25.00
	Salaries, 3 Makers @ 12.50	37.50
	Salaries, 2 Saleswomen @ 15.00	30.00
	Salary, Jeanne Gray	25.00
	Salary, Bookkeeper	10.00
	Paid to delivery boy	5.00
21	Paid Lawrence and Company bill of Apr. 16	225.40
	Cash Sales	50.00
	Sold to Mrs. K. F. Smith, on acct.	
	1 Hat 25.00	
	1 Hat 15.00	
	1 Hat 10.00	
	1 Hat 8.50	
	Mrs. L. C. Casey paid bill of Apr. 10 ...	32.50
	Sold to Mrs. A. M. Davis, on acct.	
	1 Hat 18.00	
	3 Hats @ 6.50	
	1 Hat 4.00	
22	Miss Louise Simpson paid bill of Apr. 18 ..	25.00
	Cash Sales	200.00
23	Cash Sales	25.00
24	Sold to Miss Ethel Ames, on acct.	
	1 Hat 25.00	
	Mrs. J. F. Cone paid on bill of Apr. 14 ..	20.00
	Miss Jane Bell paid bill of Apr. 15	18.50
	Miss Katherine Raye paid bill of Apr. 12	17.50
	Sold to Mrs. L. F. Fame, on acct.	
	1 Hat 20.00	
	1 Hat 10.00	

25	Sold to Mrs. L. S. Williams, on acct.	
	1 Hat 15.00	
	1 Hat 6.50	
	Sold to Miss Louise Booker, on acct.	
	1 Hat 17.50	
	Mrs. A. M. Davis paid bill of Apr. 21 ...	41.50
26	Cash Sales	40.00
	Sold to Mrs. K. F. Rivett, on acct.	
	2 Hats @ 9.50	
	1 Hat 18.00	
	Sold to Miss Jessie Larson, on acct.	
	1 Hat 25.00	
	1 Hat retrimmed 5.00	
	Sold to Mrs. N. B. Kellar, on acct.	
	1 Hat 15.00	
	3 Hats @ 8.50	
	Mrs. J. M. Bart paid bill of Apr. 16	22.00
	Salary, Trimmer	25.00
	Salaries, 3 Makers @ 12.50	37.50
	Salaries, 2 Saleswomen @ 15.00	30.00
	Salary, Jeanne Gray	25.00
	Salary, Bookkeeper	10.00
	Paid to delivery boy	5.00
	Mrs. J. F. Cone paid on bill of Apr. 14 ..	28.50
	Miss Elsie Raye paid bill of Apr. 12	15.00
28	Cash Sales	75.00
	Sold to Mrs. S. R. Perry, on acct.	
	1 Hat 8.50	
	2 Hats @ 4.50	
	Sold to Mrs. H. M. Browder, on acct.	
	1 Hat 15.00	
	1 Hat 10.00	
	1 Hat 7.50	
	Mrs. L. F. Fame paid bill of Apr. 24	30.00

	Miss Mary Simpson paid bill of Apr. 18.		20.00
	Miss Mary Grace paid bill of Apr. 14...		13.00
29	Cash Sales.....		40.00
	Sold to Mrs. J. H. Davids, on acct.		
	1 Hat.....	12.50	
	2 Hats @.....	5.00	
	1 Hat.....	15.00	
	Sold to Miss Sarah Burns, on acct.		
	1 Hat.....	25.00	
	Sold to Miss Mary Burns, on acct.		
	1 Hat.....	22.50	
	Mrs. K. F. Smith paid bill of Apr. 21...		58.50
	Miss Mary Adams paid bill of Apr. 9...		18.50
30	Sold to Mrs. S. K. Bailey, on acct.		
	2 Hats @.....	7.50	
	Sold to Mrs. J. M. Marks, on acct.		
	1 Hat.....	8.50	
	Sold to Mrs. J. L. Burks, on acct.		
	1 Hat.....	30.00	
	1 Hat.....	15.00	
	Mrs. R. A. Peele paid bill of Apr. 1.....		30.00
	Miss Ethel Ames paid bill of Apr. 24....		25.00
	Miss Louise Booker paid bill of Apr. 25..		17.50
	Miss Jessie Larson paid bill of Apr. 26 .		30.00
	Mrs. H. M. Browder paid bill of Apr. 28 .		32.50
	Mrs. K. F. Rivett paid bill of Apr. 26...		37.00
	Advertising.....		100.00
	Inventory.....		305.75

2. The forms for the trial balance and profit and loss statement for Jeanne Gray's millinery business for the month of April are given below. They should be used as a guide for forms and as a check for accuracy.

Trial Balance, April 30, 1919

		Jeanne Gray, Capital			2430	45
		Sales			2933	15
		Purchases	1592	50		
		J. F. Anderson			500	00
		Accounts receivable	383	75		
		Rent	200	00		
		Advertising	250	00		
		Salaries	510	00		
		Delivery expense	20	00		
		Fixtures	540	00		
		Cash	2367	35		
			5863	60	5863	60

Profit and Loss Statement

April 1 to April 30, 1919

		Total sales			2933	15
		Purchases	1592	50		
		Inventory, April 30, 1919	305	75		
		Cost of goods sold			1286	75
		Gross profit			1646	40
		Expenses				
		Rent	200	00		
		Advertising	250	00		
		Salary	510	00		
		Delivery expense	20	00		
		Total expense			980	00
		Net profit			666	40

3. Closing the Ledger

It is customary in business at the end of every year, or perhaps half year, to *close the ledger.*

Closing the ledger requires the use of another book called the *journal.*

These are parts of bookkeeping necessary for a professional bookkeeper, but not essential for the keeping of one's personal and household accounts.

III. Individual Business Enterprises

1. Each pupil should choose some kind of business in which he would like to engage.

By having a great variety, the class will more nearly represent a real community. Each pupil should choose for himself the business about which he can get the most information.

2. According to his line let each one make a memorandum of a month's business.

3. Enter all items in their proper books.

4. Post to the ledger.

5. Take off a trial balance.

6. Make a profit and loss statement.

7. Find what per cent of your sales your total expenses are.

8. Your net profit is what per cent of your capital?

9. At the end of a week, bring your small set of books to class.

10. Compare your profit and loss statements with each other.

CHAPTER FOUR

TESTS OF ACHIEVEMENT

A. PROBLEMS

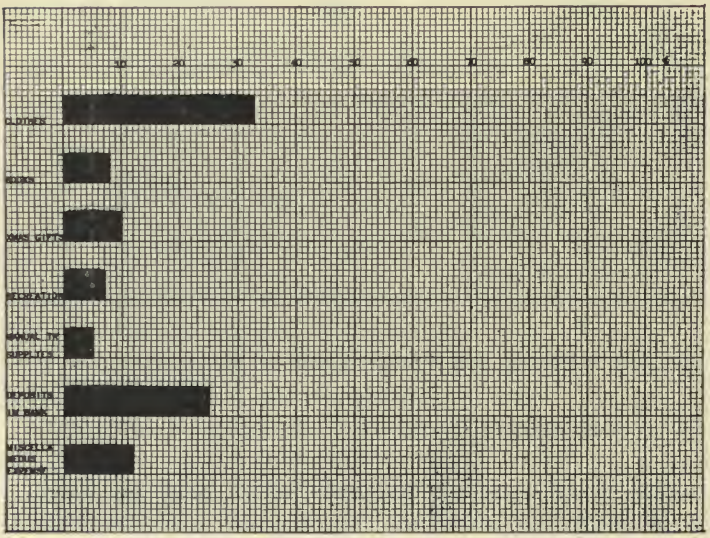
1. (a) Did you earn any money during the summer vacation, or do you earn any by working after school and on Saturdays?

(b) Make a bar graph showing the various amounts spent for different things.

(c) What per cent of your money was put in a savings bank?

2. (a) During his summer vacation, a high school boy earned $9 a week for ten weeks.

The following graph shows what he did with the money:



(b) How much did the boy earn?

(c) How much did he spend for each item?

(d) How much did he put in the savings bank?

(e) If it drew 4% interest, compounded semi-annually, how much would it amount to in ten years?

3. (a) Business men lose large sums of money every year because clerks are not accurate in their calculations. An actual example is of a clerk selling 30 inches of oilcloth at \$.55 a yard, asking \$.35 for it. When asked how she figured, she said it was 3 inches over half a yard. After several attempts the customer told her the amount.

(b) How would you calculate such a cost?

(c) A very quick method of calculating the cost is given below:

30 inches lacks 6 in. or $\frac{1}{6}$ of a yd. of being a whole yard.

$\frac{1}{6}$ of \$.55 = \$.09 (in round numbers)

\$.55 − \$.09 = \$.46 cost of oilcloth

4. Without pencils, figure the cost of the following:

(a) $\frac{7}{8}$ yard of lace at \$.30 a yard.

(b) 27 inches of banding at \$2.50 a yard.

(c) $13\frac{1}{2}$ ounces of ground meat at 28 cents a pound.

(d) $4\frac{3}{4}$ pounds of rib roast at \$.35 a pound.

NOTE : How much does the roast lack of being 5 pounds?

(e) $1\frac{7}{8}$ pounds of butter at \$.56 a pound.

5. (a) Sometimes clerks make errors that cheat the customer as well as the proprietor. It is always wise to make your own calculations when making purchases. Be sure to make them in the quickest way.

(b) Make up ten or more problems like the foregoing ones. Use them for rapid calculation matches for five minutes each day at the beginning of the class period.

6. A boy who has a large paper route found he could not make all of his own collections on Saturday morning, so he hired another boy to help him. Instead of paying his assistant for his time, the newsboy paid him 3% commission. How much did the assistant earn if he collected $24.60?

7. A coal dealer bought 28 tons of coal at $3.45 a gross ton (2240 lb.). His expenses for freight and delivery were $1.20 a gross ton. He sold it at retail at $6.50 a short ton. What was his profit?

8. (a) The weather record for a week showed the following maximum and minimum daily temperatures:

TEMPERATURES

	Maximum	*Minimum*
Monday	65°	39°
Tuesday	46	32
Wednesday	48	20
Thursday	25	11
Friday	18	5
Saturday	27	13
Sunday	32	21

(b) What is the average or mean maximum temperature for the week?

(c) What is the mean minimum temperature?

(d) Draw a graph of the maximum temperatures.

(e) On the same graph show the week's minimum temperatures, by using a different kind of line or a different kind of ink.

(f) From the graph tell on which days the temperature varied the most.

9. Keep a similar record for a week of the variations in temperature in your locality. Find the mean temperatures and draw the graphs.

10. (a) The following is part of a newspaper advertisement by a savings bank:

SEE HOW FAST MONEY GROWS

Deposits of $1.00 to $10.00 Weekly at 5% Compounded Semi-Annually

ACCUMULATE AS FOLLOWS:

Weekly Deposits	1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years	9 years	10years
$1.00	$53.32	$109.80	$168.06	$229.72	$294.41	$362.24	$433.32	$507.83	$585.83	$677.55
2.00	106.61	218.58	336.13	459.43	588.82	724.49	866.65	1,015.67	1,171.67	1,335.11
3.00	159.91	327.89	504.17	689.18	883.23	1,086.74	1,299.98	1,523.51	1,757.51	2,002.67
4.00	213.22	437.21	672.25	918.88	1,177.64	1,448.96	1,723.29	2,031.35	2,343.35	2,670.23
5.00	266.54	546.50	840.29	1,148.59	1,472.05	1,811.24	2,166.64	2,539.19	2,929.19	3,337.79
6.00	319.83	655.78	1,008.36	1,378.32	1,766.48	2,173.49	2,599.97	3,047.03	3,515.03	4, 05.30
7.00	373.15	765.07	1,176.42	1,608.02	2,060.96	2,535.74	3,033.30	3,554.87	4,100.87	4,672.91
8.00	426.45	874.28	1,344.52	1,837.76	2,355.37	2,897.99	3,466.63	4,062.71	4,686.71	5,340.47
9.00	469.76	983.72	1,512.51	2,067.58	2,649.78	3,260.24	3,899.96	4,570.55	5,272.55	6,008.03
10.00	532.56	1,092.91	1,680.65	2,297.35	2,944.21	3,622.49	4,333.44	5,078.35	5,858.43	6,675.59

5% **It is not what you *Earn*, it is what you *Save*, that counts**
Today! NOW is the time to open a Savings Account 5%
$1.00 WILL START YOU

(b) If $1 is deposited weekly, how many dollars are deposited in one year? in 10 years?

(c) What do weekly deposits of one dollar amount to in 10 years?

(d) How much of this amount has been deposited?

(e) How much of it is interest?

(f) What per cent of the amount of deposits is this total interest?

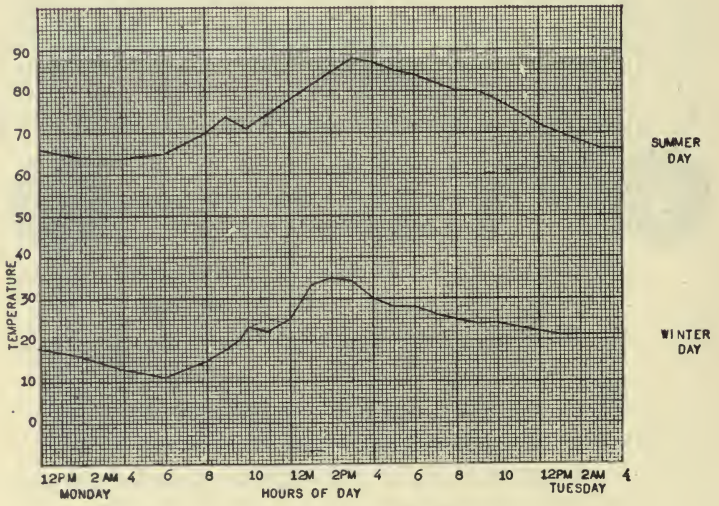
(g) How much interest accrues in 10 years on weekly deposits of $5?

(h) When are you going to start a savings account?

(i) When does the advertisement say is the right time?

11. (a) If there is a weather bureau in your community, you will find a trip to it worth while. If possible, make a visit to one and find out how a record of the changes in temperature is kept.

(b) The weather man need not look at the thermometer every hour to record the temperature. On an instrument the change in temperature makes a little needle-like pencil trace a line on a piece of graph paper. This paper is marked off in hours, so that the weather man can read a record of all the changes during the night or whenever he is away.



(c) These two graphs show the variations in temperature on two days, one in summer and one in winter.

(d) Read the temperature for each hour of the day in each graph.

(e) What hour in each was the coldest?

(f) What hour in each was the warmest?

(g) Which graph shows the greatest range in temperature?

(h) How many, and which hours of the winter day were above freezing?

(i) Find the average temperature for each day.

12. (a) Make a temperature graph from the following data:

12	P.M.	70°	12	M.	86°
1	A.M.	69	1	P.M.	87
2	"	68	2	"	88
3	"	68	3	"	75
4	"	68	4	"	70
5	"	69	5	"	68
6	"	70	6	"	67
7	"	72	7	"	67
8	"	74	8	"	66
9	"	77	9	"	65
10	"	82	10	"	64
11	"	85	11	"	63

(b) Describe the kind of day you think this was, judging from the appearance of your graph.

(c) What probably happened between 2 and 3 P.M.?

13. (a) Take thermometer readings each hour of the day from the time of rising to the hour of retiring.

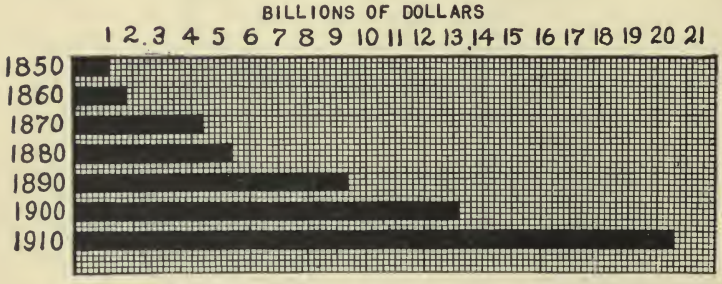
(b) Make a graph of the record.

14. (a) Our papers and magazines are full of statistics about agricultural products, manufactures, expenses of the Government, and the like that

are very large numbers, in the billions. We cannot think in billions. A billion is too large a number.

(b) On April 29, 1902, at 10.40 A.M. only a billion minutes had elapsed since the birth of Christ.

(c) Because these numbers are so large we find it easier to understand these statistics if they are pictured in graphs.



GRAPH SHOWING THE TOTAL VALUE OF PRODUCTS MANUFACTURED IN THE UNITED STATES IN EACH CENSUS YEAR FROM 1850 TO 1910.

(d) Read the approximate value for each year.

(e) How many years did it take to double our manufactured products after 1850?

(f) In how many years were they approximately doubled again?

(g) When were they doubled a third time?

(h) Which decade showed the least progress? which the greatest?

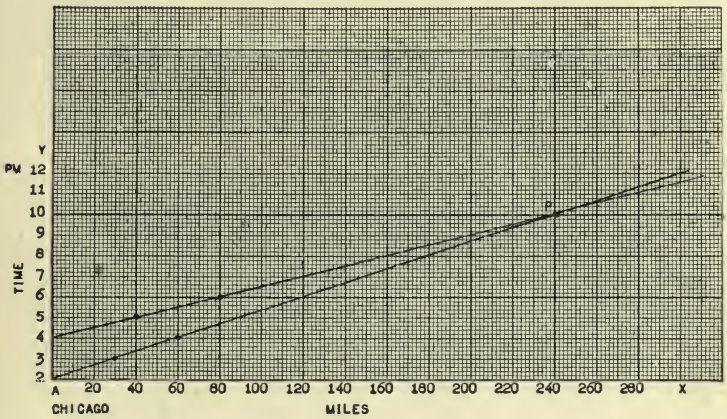
15. (a) Some problems may be solved more quickly by drawing graphs than by making the arithmetical calculations. Graphs are especially convenient in finding when and where two

railroad trains will meet or overtake each other.

(b) A train leaves Chicago at 2 P.M. and travels 30 miles an hour. At 4 P.M. a second train starts from Chicago, going in the same direction at 40 miles an hour.

The first train needs to know when and where it will have to sidetrack in order to let the second train pass.

(c) The following graph shows the hour and distance from Chicago at which the second train overtakes the first.



(d) On the horizontal line, AX, let each space denote 10 miles.

On the vertical line, AY mark the hours, beginning with 2 o'clock, the time the first train starts.

(e) If the first train goes 30 miles an hour, it will be 30 miles from Chicago at 3 o'clock. To mark

the point, put a dot opposite 3 o'clock and above 30 miles. Through this dot and the point A draw a long line.

(f) At what point should the line for the second train start?

If it starts at 4 o'clock and travels 40 miles an hour, where will it be at 5 o'clock? Mark the point with a dot.

Through this dot and the 4 o'clock starting point, draw a line long enough to intersect the line of the first train.

(g) This point of intersection is opposite the 10 o'clock hour and above the 240-mile mark. That means that the second train will overtake the first at 10 P.M., 240 miles from Chicago.

(h) At what hour is each train 120 miles from Chicago? 180 miles?

(i) How many miles away is each train at 5 o'clock? at 6 o'clock? at 7 o'clock?

(j) How many hours did the first train travel? At 30 miles an hour how far did it go?

(k) How many hours did the second train travel? At 40 miles an hour, what distance did it go?

(l) How do these two distances compare? Does this calculation show your graph to be correct?

16 (a) By letting each space on AY be $\frac{1}{2}$ hour and each space on AX be 5 miles, more exact time and distances may be read from the graph.

(b) A freight train leaves Lancaster at 11 A.M. traveling 25 miles an hour. Two and one-half hours later a passenger train going at 40 miles an hour leaves Lancaster going in the

same direction. At what time, and how many miles from Lancaster, will the passenger train overtake the freight train?

(c) Draw a graph and read it.

17. Make up four such problems and draw their graphs. They need not all be about trains. They may deal with any means of travel at different speeds, as, walking, boating, riding a bicycle, in a carriage or an automobile, or on a motorcycle.

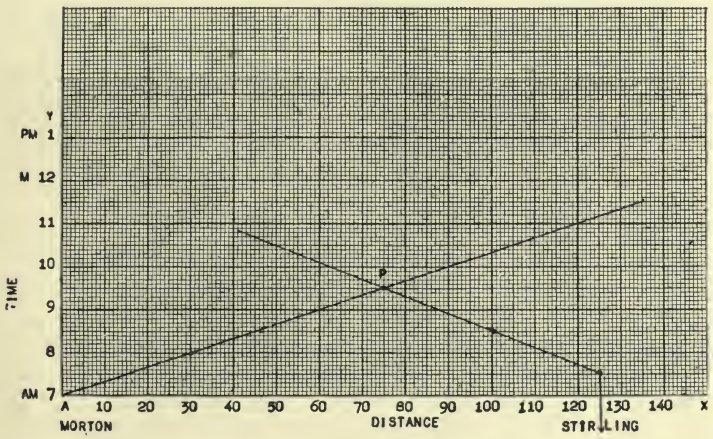
18. The next graph shows how to find the time and place at which two trains meet when coming toward each other.

Two towns, Morgan and Stirling, are 125 miles apart.

A train leaves Morgan at 7 A.M. going toward Stirling at 30 miles an hour.

At 7.30 A.M. one leaves Stirling for Morgan going at 25 miles an hour.

At what time and how far from Morgan will they meet?



19. Make up four problems of this kind.
Draw their graphs and read them.

20. FRIDAY MORNING, JANUARY 31, 1919

LOCAL RETAIL MARKET

FRUITS

Apples, peck....60 @ $1
Bananas, doz....30 @ 40c
Cranberries, qt.....35c
Cocoanuts, each..15 @ 20c
Dates, pkg.....25 @ 30c
Figs, Cal., pkg....10 @ 20c
Grape fruit, each..5 @ 15c
Honey, box.....35c
Lemons, doz.....25 @ 40c
Oranges, doz.....20 @ 75c
Pineapples, each..35 @ 50c
Rhubarb, bunch.....15c
Strawberries, quart.....85 @ 90c
Tangerines.....25 @ 50c

VEGETABLES

Artichokes, each.....25c
Beans, green, lb.....30 @ 35c
Wax, lb.....30 @ 35c
Celery cabbage, lb....30c
Beets, ¼ peck.....10c
Brussels Sprouts, quart.....35 @ 50c
Cabbage, head...5 @ 15c
Carrots, ¼ pk.....10c
Cauliflower, head.....25 @ 40c
Celery, stalk.....10 @ 25c
Cucumbers, each.....35 @ 50c
Eggplant, each.. 20 @ 35c
Endive, ¼ pk.....25c
Garlic, lb.....$1.00
Lettuce, head....15 @ 25c
Leaf.....40c
Mango Peppers, each.....5 @ 10c
Onions, lb.....3 @ 5c
Green, bunch.....10c
Oyster Plant, 2 bunches.....15c
Parsley, 2 bunches....15c
Potatoes, pk.....45 @ 60c
Baking potatoes, lb..3½c
Radishes, long, bch....10c
Button.....10c
Spinach, ¼ pk.....20c
Tomatoes, hothouse, lb.....50c
Southern.....40c

POULTRY

Chickens, alive, lb.....35c
Dressed, lb.....40c
Ducks, alive, lb.....35c
Dressed, lb.....45c
Geese, alive, lb.....35c
Dressed, lb.....45c
Turkeys, alive, lb.....55c
Dressed, lb.....60c

BUTTER AND EGGS

Creamery, lb.....60c | Eggs, fancy, per dozen.....60c

CHEESE

Michigan, flat, lb.....45c
Wisconsin, flat, lb....45c
Wisconsin Daisies, lb.....50 @ 55c
Long Horn, lb.....50c
Limburger, lb.....45c
Brick, lb.....50c
Domestic Swiss.....60c
Block Swiss.....50c
New York Cream.....48 @ 50c

MEAT

Bacon, in piece (side or half)..50 @ 60c
Sliced.....55 @ 65c
Ham — Whole..38 @ 40c
Boiled.....60c
Minced.....35c
Pressed.....35c
Sliced (best cuts).....55 @ 60c
Lard.....30c
Pork Chops.....30 @ 35c
Roast.....30 @ 35c
Tenderloin....45 @ 50c
Shoulder Roast.....25c
Sausage.....30 @ 35c
Lamb Chops.....50 @ 60c
Roast (leg)....35 @ 40c
Stew.....25 @ 30c
Beef, corned.....25 @ 30c
Beef Roasts — Chuck.....25 @ 30c
Rump.....30 @ 35c
Rib.....35 @ 40c
Boiling Pieces (ribs).....18 @ 23c
Steak — Sirloin..35 @ 40c
Porterhouse...40 @ 60c
Round.....30 @ 35c
Veal — Cutlets..40 @ 45c
Stews.....25 @ 30c
Chops.....25 @ 35c
Wieners.....30c

FISH

SEA FISH

Bluefish.....50c
Butterfish.....30c
Cod, fresh.....25c
Haddock.....20c
Halibut, frozen.....35c
Fresh.....40c
Sablefish.....25c
Salmon, Chinook.....40c
Shad (Roe).....60c
Smelts.....35 @ 40c
Spanish Mackerel.....35c
Tilefish.....25c

LAKE FISH

Bullheads.....35c
Carp.....20c
Catfish.....35c
Boneless Herring.....25c
Perch, yellow.....30c
Saugers.....25c
Whitefish (Jumbo)....40c
Whitefish (Erie).....35c
Whitefish (Superior)...35c
Yellow Pickerel..30 @ 35c
Lake Trout.....35c

SMOKED FISH

Finnan Haddie.....35c
Sturgeon.....60c
Bloaters, each.....10c

SALT FISH

Mackerel, lb.....30c
Cod, lb.....30c
Herring.....30c
Herring, boned.....45c

SEA FOOD

Lobsters, alive.....$1.25
Shrimp, fresh, lb.....30c
Cooked, lb.....50c
Steamed.....60c
Eels, lb.....35c
Scallops, qt.....$1.25

OYSTERS — BULK

Standards, qt.....70c
Selects, qt.....90c
N. Y. Counts, quart.....$1.00

OYSTERS — SHELL

Blue Points, doz.....35c
Cotuits, doz.....40c
Box, doz.....50c
Lynn Haven, doz.....50c
Rockaway, doz.....50c

CLAMS

Large, doz.....50c
Little Necks, doz.....35c

(a) The above retail price list was clipped from a newspaper.

(b) From it make a Saturday marketing list for a family of six.

(c) Make an itemized list showing amounts of purchases, with extensions and footings.

21. Practice on the short cuts given in Chapter One.

22. (a) Make a sales slip or invoice of a purchase of wholesale groceries by a retailer.

(b) The terms of the bill are 60 days; less 3%, 10 days; 2%, 30 days.

(c) Find the cost of the goods if paid in 10 days; in 30 days.

23. (a) Make out a monthly statement of a retail hardware store or a dry goods store.

(b) Pay the bill by check.

(c) Indorse it for the merchant and deposit it in the bank with two other checks and $45.75 in cash.

24. Give the following rapidly without pencil:

5% of $600?	$12\frac{1}{2}$% of $2500?
$2\frac{1}{2}$% of 600?	$37\frac{1}{2}$% of 3200?
50% of 600?	$16\frac{2}{3}$% of 270?
3% of 600?	$33\frac{1}{3}$% of 750?
6% of 600?	$87\frac{1}{2}$% of 2.80?
1% of 600?	$83\frac{1}{3}$% of 7.20?
.1% of 600?	25% of 4.50?
7% of 150?	$66\frac{2}{3}$% of 4.50?
5% of 150?	$62\frac{1}{2}$% of 7.20?
3% of 150?	2% of 13.50?
10% of 150?	1% of 2000?
15% of 150?	.1% of 2000?
20% of 150?	$\frac{3}{4}$% of 2000?
25% of 150?	$\frac{1}{4}$% of 1600?
30% of 150?	$6\frac{1}{4}$% of 1600?

25. (a) The tax rate in a city is \$15.60 on \$1000.
Out of this \$15.60 the state tax is \$.45; the county, \$3.68; the school, \$5.39; the city corporation, \$6.08 on each \$1000.

(b) If the tax duplicate is 325 million dollars, how much money does each receive?

(c) If the city has 225,000 inhabitants, how much per capita is spent for the schools? for the city government?

(d) Compare with the per capita expense in your city.

(e) The levy of \$6.08 for the corporation is distributed as follows:

General Purposes	\$ .14 on each \$1000
Public Health	.14
Public Safety	1.00
Public Service	.79
Public Library	.15
Sinking Fund	3.73
Firemen's Pensions	.06
Police Relief	.07
	\$6.08

(f) How much does each department of the city receive?

26. The production of raw materials in the United States compared with the production in all the countries of the world is shown in the per cents listed below.

Make a bar graph showing these per cents.

75% of all corn
72% of all oil
70% of all cotton
59% of all copper
43% of all pig iron
37% of all coal
35% of all tobacco

26 % of all silver
24 % of all wheat
21 % of all gold

27. An Actual School Garden Project

Olive Sands had a garden 50 × 50 ft. In her garden she raised tomatoes, green beans, carrots, cabbages, mangoes, lettuce, radishes, beets, cucumbers, onions, and peas. Besides furnishing vegetables for a family of five throughout the summer, she put up for winter use 75 quarts of tomatoes, 55 quarts of green beans, 3 gallons of sauerkraut, 4 gallons of stuffed mangoes, 1 bushel of carrots, and $1\frac{1}{2}$ bushels of beets.

(a) (1) How many square feet does her garden contain?

(2) Approximately what part of an acre was the garden?

(b) From the following data find the value of her products:

75 quarts of tomatoes @ 25¢ a quart
55 quarts of green beans @ 20¢ a quart
3 gallons of sauerkraut @ 40¢ a gallon
4 gallons of stuffed mangoes @ 60¢ a gallon
1 bushel of carrots @ $1.50 a bushel
$1\frac{1}{2}$ bushels of beets @ $1.00 a bushel
1 bushel of cucumbers @ $3 a bushel
1 bushel of onions @ $1.50 a bushel
50 pounds of peas @ 10¢ a pound
2 dozen heads of cabbage @ 10¢ a head.

(c) Estimating the vegetables used by the family through the summer at $15, what was the total value of the products?

(d) If seeds, fertilizer, and water cost $10, what would have been her profit had she sold her products?

(e) What were her wages an hour if she labored 150 hours?

28. Money Value of an Education

Chances to reach distinction in any field, whether in business, the arts, or the professions, are shown in the following statistics.

(a) Those who leave school at the end of the sixth grade or earlier	1 chance in 150,000
(b) Those who complete the ninth grade	1 chance in 37,500
(c) Those who complete the high school	1 chance in 1,724
(d) Those who graduate from college	1 chance in 187.5

(e) How many times greater are the chances for one in each of the last three groups than in the first?

29. Memorandum of Dry Goods Business for Month

(a) On August 1, 1919, W. C. Gates, a dry goods merchant, had a capital of $7497.68. His net profit for August was $213.45. What was his total capital for September, if he put the August profit into the business?

(b) His August inventory was $6460.40.

(c) The memorandum given below shows his transactions for the month of September.

(d) Enter all items in the cashbook, sales book, or purchase book.

(e) Post to the ledger.

(f) Take off a trial balance.

(g) Make a profit and loss statement.

(h) The total expenses are what per cent of the total sales?

(i) The net gain is what per cent of his capital?

(j) Memorandum: Cash Balance $1250.73

Sept. 2 Rent for September..... 75.00

Cash Sales..... 49.06

Sold to Mrs. J. M. Rogers, on acct.

1 Suit..... 35.00

Alterations..... 1.00

3 Sold to Mrs. K. M. Cantis, on acct.

2 pairs blankets @ 8.00

6 sheets @ 1.75

Cash Sales..... 77.42

Bought of Joyce-Paxson, Mdse..... 650.00

4 Sold to Miss Margaret Hutchins, on acct.

10 yd. lace @ ..... .18

7 yd. insertion @ ..... .18

Cash Sales..... 45.63

5 Cash Sales 85.17

Bought wrapping materials..... 5.00

6 Sold to Miss Louise Jones, on acct.

1 house dress..... 4.00

5 yd. longcloth @ ..... .35

Cash Sales 50.25

Paid for telephones..... 4.25

Paid salary to 4 clerks, 12.50 each.....

Paid to delivery boy..... 3.00

Paid himself a salary..... 50.00

8 Cash Sales 96.55

Paid gas bill for August..... 3.00

Paid electric light bill for August..... 3.60

Sold to Mrs. T. R. McCarty, on acct.

1 shirt waist..... 3.50

5 spools thread @ ..... .06

5 yd. gingham @..... .40

9	Bought supplies	5.72
	Paid Joyce-Paxson bill of Sept. 3	
	Cash Sales	95.69
10	Cash Sales	60.10
	Sold to Mrs. S. P. Moray, on acct.	
	2 yd. oilcloth @ .40	
	1 bedspread 4.00	
	Miss Margaret Hutchins paid bill of Sept. 4	
11	Cash Sales	68.92
12	Cash Sales	102.13
	Sold to Mrs. S. L. Slater, on acct.	
	2 doz. buttons @ .15	
	1 yd. lining .35	
	5 yd. silk @ 2.00	
	1 spool thread .10	
	1 card clasps .10	
	Bought of Rich & Sons, Mdse	862.15
	Paid for advertising	25.00
13	Cash Sales	71.15
	Salary, 4 clerks @ 12.50	
	Paid to delivery boy	3.00
	Salary, W. C. Gates	50.00
	Mrs. J. M. Rogers paid bill of Sept. 2	
15	Miss Louise Jones paid bill of Sept. 6	
	Sold to Mrs. C. H. Carter, on acct.	
	5 yd. ribbon @ .35	
	4 yd. domestic @ .37½	
	Cash Sales	78.10
16	Sold to Miss Margaret Jones, on acct.	
	1 skirt 7.00	
	1 waist 3.98	
	Cash Sales	63.85
17	Cash Sales	58.17

Bought of Chamberlain Houston Company, Mdse..... 458.37

18 Cash Sales 69.72

Paid Rich & Sons, on acct..... 500.00

19 Cash Sales 48.97

Sold to Mrs. S. A. Newton, on acct.

2 pairs curtains @..... 4.50

20 Cash Sales 66.22

Salary, 4 clerks @ 12.50.....

Paid to delivery boy..... 3.00

Salary, W. C. Gates..... 50.00

Sold to Mrs. A. T. Perry, on acct.

1 pair cotton blankets... 5.00

2 sheets @..... 1.60

Mrs. T. R. McCarty paid bill of Sept. 8.

Mrs. S. P. Moray paid bill of Sept. 10...

22 Paid Chamberlain Houston Company bill of Sept. 17..... 458.37

Cash Sales 70.16

23 Cash Sales 120.32

Sold to Mrs. A. L. Barton, on acct.

12 handkerchiefs @ .... .20

4 buttons @ ..... .50 doz.

24 Cash Sales 66.71

Sold to Miss Elsie Mays, on acct.

10 yd. cretonne @ ..... .45

2 spools thread @ ..... .06

25 Sold to Mrs. L. M. Turner, on acct.

1 suit..... 30.00

Paid Rich & Sons in full.....

Cash Sales 129.16

26 Cash Sales 64.25

	Sold to Mrs. R. A. Telling, on acct.		
	2 wool comforts @	5.00	
27	Cash Sales		100.68
	Salary, 4 clerks @ 12.50.....		
	Paid to delivery boy.....		3.00
	Salary, W. C. Gates.....		50.00
	Mrs. C. H. Carter paid bill of Sept. 15..		
29	Sold to Mrs. S. L. Carr, on acct.		
	1 waist.....	4.50	
	Cash Sales		79.62
30	Cash Sales		52.07
	Mrs. S. L. Slater paid bill of Sept. 12....		
	Sold to Mrs. S. A. Newton, on acct.		
	12 yd. gingham @.....	.50	
	4 spools thread @.....	.06	
	2 doz. buttons @	.25	
	Inventory, Sept. 30.....		7078.24

30. (a) Make up ten problems in interest.
(b) Solve your own or those of a classmate.
(c) Grade papers.
(d) Find the boys' average.
(e) Find the girls' average.
(f) Find the class average.

31. (a) Things everyone should know:
(1) How to earn money.
(2) How to spend part of it wisely.
(3) How to keep accounts correctly.
(4) How to save money.
(5) How to make money grow.
(b) How many of these do you know?
(c) What are you doing toward learning the others?

CHAPTER FIVE

MEASUREMENTS

A. USE OF MEASUREMENTS

A teacher gave the following directions to her class for the preparation of an arithmetic paper:

> Draw a line across your paper one and a quarter inches from the top. Above this line write your name at the left; 7A Mathematics, at the right; and in the upper right hand corner, write the date; and beneath it, your class period or class hour.
>
> At the left of your paper, draw a line making a margin one inch wide.
>
> In the middle of the line below the heading write the figure one.

1. Are these directions clear? If so, you should be able to follow them exactly. Try and see.
2. If the members of the class followed these directions, would all their papers be uniform except in the names?
3. What is there in the directions that causes them to be uniform?
4. Tell exactly what you did to draw the line as directed across your paper.
   (a) What did you use?
   (b) How many measures did you need?
   (c) Is one point enough?
   (d) How does it help to have two?
   (e) Is your line as far from the top at one end as at the other? If not, what is wrong?
   (f) Would the directions have been clearer if the teacher had said, "Draw a line parallel to the

edge of your paper and one and a quarter inches from it"?

(g) What word can you substitute for "edge" in the question that would make it clearer?

(h) What does parallel mean? Look up the word in the dictionary.

(i) How did you know how far from the edge to draw the line?

5. Examine the ruler that you used and tell different ways it can be used.

(a) What is meant by a straight edge?

(b) Sight along the edge of yours to test it.

(c) Why should a ruler be a straight edge?

6. (a) How long is your ruler? How do you know?

(b) What are the largest divisions on the edge of your ruler?

(c) Tell how long each different division on the edge of the ruler is.

(d) What part of an inch is indicated by the various lengths from 0 to 1 inch?

(e) Which is longer, $\frac{3}{4}$ or $\frac{5}{8}$ of an inch?

(f) Compare the following by listing them in order of size beginning with the largest:

$$\frac{1}{2}'', \frac{5}{8}'', \frac{11}{16}'', \frac{1}{4}'', \frac{3}{8}'', \frac{17}{32}'', \frac{3}{4}'', \frac{15}{16}'', \frac{7}{8}'', \frac{31}{32}''.$$

Note: The mark $''$ is sometimes used for inch or inches. The mark $'$ means foot or feet.

7. (a) Measure the page of your book as accurately as you can.

(b) Do all the pupils get the same measure?

(c) Why is it probable that they will not?

(d) Have you seen one of those instruments used in some dry goods stores by clerks to measure cloth and other yard goods? Why does it pay the

proprietor to go to the expense of putting in these instruments?

(e) Have several members of the class measure each of a number of convenient objects, and compare the accuracy of their measures.

(f) Perhaps some boy has worked many hours in the wood shop making some piece of furniture, only to find at the end that some part did not fit. That meant his time and material were lost. What might have prevented this disappointment? Let some boys tell of their experiences.

(g) Wherein has a girl failed when her pie crust is tough or her cake heavy?

(h) What will these boys and girls learn from such experiences, especially if the piece of furniture was being finished just in time for mother's Christmas or the cake baked for a birthday party?

8. Name some different occupations and tell how measurement enters into the work. Which ones must be more accurate than others? For example:

(a) What does the carpenter measure? What does he use in making his measurements? What would be the results and cost of inaccurate measurements?

(b) What does the grocer measure? What different kinds of measures does he use for various articles? Which are the fairest to the customer?

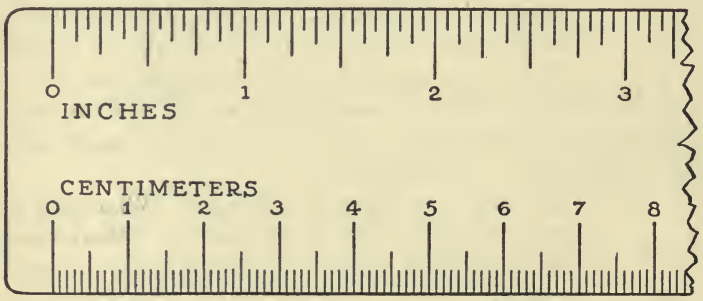
(c) In like manner compare the use of measurements and need of accuracy in the following occupations: architecture, surveying, dressmaking, engineering, automobile industry, jewelry business, chemistry, interior decoration, pharmacy, machinery, manufacture of lenses and optical instruments.

9. (a) What does it mean to measure the following:

(1) A boy's weight
(2) Size of a room
(3) Apples
(4) Potatoes
(5) Eggs
(6) Coal
(7) Fuel gas
(8) Dress material
(9) Gold
(10) Water
(11) A field
(12) Railroads
(13) Letter paper
(14) Distance
(15) Cost
(16) Time

B. MEASURING LENGTHS—ENGLISH UNITS

1. Some rulers have the two edges marked with two different measuring units. The one most familiar to the American school boys and girls is measured in inches.



Ruler with Two Measuring Units

2. The upper edge is laid off in inches and fractional parts of inches, as halves, quarters, and eighths. It is the common or English scale, a part of the English table of linear or length measure.

(1) The word linear comes from a Latin word meaning line. Since the length of any object is always measured in a straight line, the measures used are called linear measures. The various units of linear measure are inches, feet, yards, rods, miles.

(2) Why do we need more than one unit to measure a length?
(3) How long is a foot measured in inches? A yard?
(4) How long is a yard measured in feet?
(5) How long is a rod measured in yards? In feet?
(6) How long is a mile measured in rods? In feet?

3. (a) Estimate the length and width of your school room in feet. In yards. In rods.
(b) Measure each to check your estimate
(c) Why is the inch unit not suitable for use in measuring the room?

4. (a) Estimate the length and width of your school yard in rods. Measure both.
(b) What part of a mile is each?
(c) How many times in play do you run back and forth across the school yard each day?
(d) How many miles each day do you run in such play?
(e) How far from the school building is your home?
(f) How many miles a day do you walk in going to and from school?
(g) Is that more or less than the number of miles you run in your play?

5. If you walked one mile north of your school, what would be your location?

Locate a place approximately one mile south of your school; one mile east; and one mile west.

6. How long is a quarter-mile running track? A half-mile track?

7. How long is a 440-yard dash? A 220-yard dash?

C. MEASURING LENGTHS—METRIC UNITS

1. The lower edge of the ruler is laid off in units that are much smaller than the inch. Each of these units is called a *centimeter.*

(a) Examine your ruler and tell about how many of these centimeters it takes to make one inch; to make two inches.

(b) Approximately what part of an inch is one centimeter?

(c) The length of the smallest measure on the English scale is what part of an inch? How many of these small parts are there in one inch?

(d) Into how many small parts is the centimeter divided? What fractional part of a centimeter is each one?

(e) Each one of these small parts of a centimeter has a name. It is called a *millimeter.*

2. The centimeter and millimeter are two units in the long or linear measure that are just as familiar to the French or Italian boy as the feet and inches of the English table are to you. This system of measure is called the *metric system.*

3. (a) Because the metric system is unfamiliar to you, it may seem difficult, but the French boy can prove that his table is more easily learned, because his is a decimal system.

(b) He does not have to learn such numbers as 12, the number of inches in a foot, 3, $5\frac{1}{2}$, and 160 as in the English table. He knows that ten of any unit makes one of the next larger. Thus:

10 millimeters (abbreviated mm.) equal 1 centimeter
10 centimeters (cm.) equal 1 decimeter
10 decimeters (dm.) equal 1 meter (m.)

(c) There are three other still larger measures, the largest of which is a kilometer (km.) which contains 1000 meters.

(d) The word *meter* means measure. You know it in the words speedometer, thermometer, gas meter, and others. The prefixes *deci-*, *centi-*, and *milli-*, will be familiar to pupils who have studied Latin,

as meaning *ten*, *one hundred*, and *one thousand*, respectively. A decimeter, therefore, is one-tenth of a meter; a centimeter is one one-hundredth of a meter; and a millimeter is one one-thousandth of a meter. These Latin prefixes are used to show the fractional parts of a meter.

To show the larger units the Greek prefixes which mean ten, hundred, and thousand are used. Thus, *kilo-* comes from the Greek word, kilos, which means *one thousand*. So a kilometer is one thousand meters.

4. (a) To further prove that the metric system is really the easier, let us compare our own United States money with English money. Our money is based on the decimal system, for it takes 10 cents to make a dime and 10 dimes to make a dollar.

(b) How easy it is to compute costs and add or subtract dollars and cents as shown in the following problem!

A mathematics book cost $ .86; a science book, $1.32; drawing instruments $6.50; 2 note books, 45 cents each; 6 pencils, 10 cents each. What is the total cost? How much change should be received from a 20-dollar bill?

Mathematics book.....	$ .86
Science book.....	1.32
Drawing set.....	6.50
2 Note books @ $ .45...	.90
6 Pencils @ .10.....	.60
Total.....	$10.18

$20.00
10.18
$ 9.82 change

(c) The table of English money is not decimal, i.e., it is not based on ten. It is as follows:

4 farthings (f) make 1 penny (d)
12 pence make 1 shilling (s)
20 shillings make 1 pound (£)

The English sovereign is a gold coin worth one pound. It is worth a little less than five dollars in United States money.

(d) The approximate equivalents are:

1 farthing = $\frac{1}{2}$ cent
1 penny = 2 cents
1 shilling = 25 cents
1 pound = 5 dollars

(e) Compute the following bill in English money.

1 Coat	5£	6s	
1 Shirt		5s	8d
1 Pr. shoes		14s	10d
2 Handkerchiefs @ 2s 8d		5s	4d
2 Ties @ 3s 9d		7s	6d
Total	6£	19s	4d

(f) How much change would there be from a 10-pound note?

10£			
6£	19s	4d	
3£	0s	8d	change

(g) Compare these two money systems as to ease of computation.

(h) Why is the one so much easier than the other?

(i) For the same reason the metric system of measurement is easier than the English system.

(j) This paragraph is not given with the idea that pupils will learn English money but that they

may see that the metric system is as much easier than the English measures of length as our United States money is easier than English money. Such a comparison gives a greater appreciation of decimals, also.

5. (a) Perhaps, your class room has some meter-sticks as well as yard-sticks.
   (b) How long is a yard stick in inches? In feet?
   (c) How long is a meter stick, measured in inches? It is 39.37 inches. How much longer than a yard? How long is a meter stick measured in decimeters? Measured in centimeters? Measured in millimeters?
   (d) What part of a kilometer is a meter? What part of a mile, approximately, is a kilometer?
   (e) Some pupil will find it interesting to read in the library and report to the class how the metric system was originated; exactly what determines the length of a meter; how men changed from indefinite units of measure to fixed or standard units; what some old units are, as pace, hand, cubit, chain, ell, span, perch, pole, palm.

6. Although the English units are commonly used in the United States and England, it must not be inferred that the metric system is not used. As a matter of fact, it is used daily by thousands of people in the United States. Indeed, each of you will use it when you study chemistry and physics, if not before, for all scientists use it, because its calculations are so easy.

7. (a) Draw several lines of different lengths.
   (b) Estimate the length of each in inches. In centimeters.
   (c) Measure each in inches. In centimeters.

8. The following is a table of English and metric equivalents for reference.

(a) 1 in. = 2.54 cm., approximately $2\frac{1}{2}$ cm.
1 ft. = 30.48 cm., " $30\frac{1}{2}$ cm.
1 yd. = 91.44 cm., " $91\frac{1}{2}$ cm.
= .9144 m., " .9 or $\frac{9}{10}$ m.
1 mi. = 1609 344 m., " $1609\frac{1}{3}$ m.
= 1.6093 km., " $1\frac{3}{5}$ km.

(b) 1 mm. = .03937 in., almost .04 in.
1 cm. = .3937 in., " .4 or $\frac{2}{5}$ in.
1 dm. = 3.937 in., " 4 in.
1 m. = 39.37 in., " 40 in.
= 3.2808 ft., approximately $3\frac{1}{4}$ ft.
= 1.0936 yd. " 1.1 or $1\frac{1}{10}$ yd.
1 km. = 3280.8 ft.
= 1093.6 yd.
= .62137 mi., " $\frac{5}{8}$ mi.

(c) The pupil should know these approximate equivalents:

1 in. = $2\frac{1}{2}$ cm.
1 cm. = $\frac{2}{5}$ in.
1 yd. = $\frac{9}{10}$ m.
1 m. = $1\frac{1}{10}$ yd.
= $39\frac{1}{3}$ in.

(d) In measuring very short lines, the millimeter unit is sometimes used. But if the line is longer than a centimeter, its length is usually read in centimeters and tenths of centimeters. Thus a line 3 cm. and 8 mm. long is read as 3.8 cm. long. A line more than a meter long is read, not as 2 meters, 65 cm. but as 2.65 m., or possibly as 265 cm.

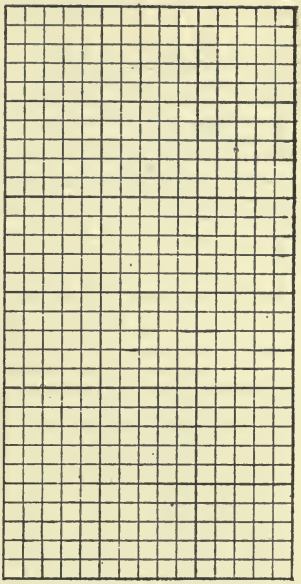
9. Draw lines with the following lengths:

(a) 3.5 cm. (f) 12 cm. (k) 4.3 cm. (p) 1 cm.
(b) 6 cm. (g) 2.2 cm. (l) 8 mm. (q) 11.1 cm.
(c) 5 mm. (h) 18 mm. (m) 10 cm. (r) 20 mm.
(d) 8 cm. (i) $4\frac{1}{2}$ cm. (n) 10 mm. (s) 6.9 cm.
(e) .8 cm. (j) 7.6 cm. (o) 12 mm. (t) $5\frac{7}{10}$ cm.

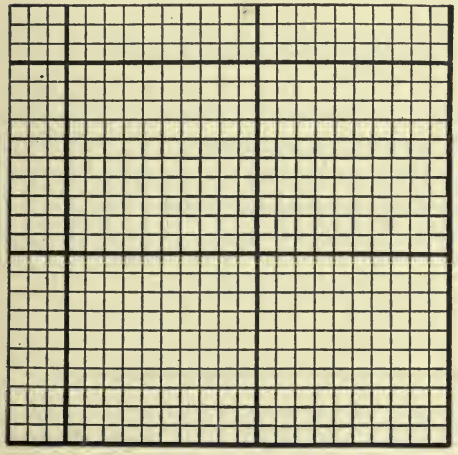
D. MEASURING LINES ON SQUARED PAPER

1. Squared paper or cross-section paper, which you have used in making graphs, is made with squares of different sizes.

(a) One kind has the larger squares of one inch on a side in heavier lines, divided into tenths of inches. With the ordinary ruler, one may draw lines in fractions of an inch, in halves, fourths, eighths, or sixteenths. But with such squared paper, one may measure lines correct to tenths of inches, or, by making estimates, may measure them in hundredths of an inch.



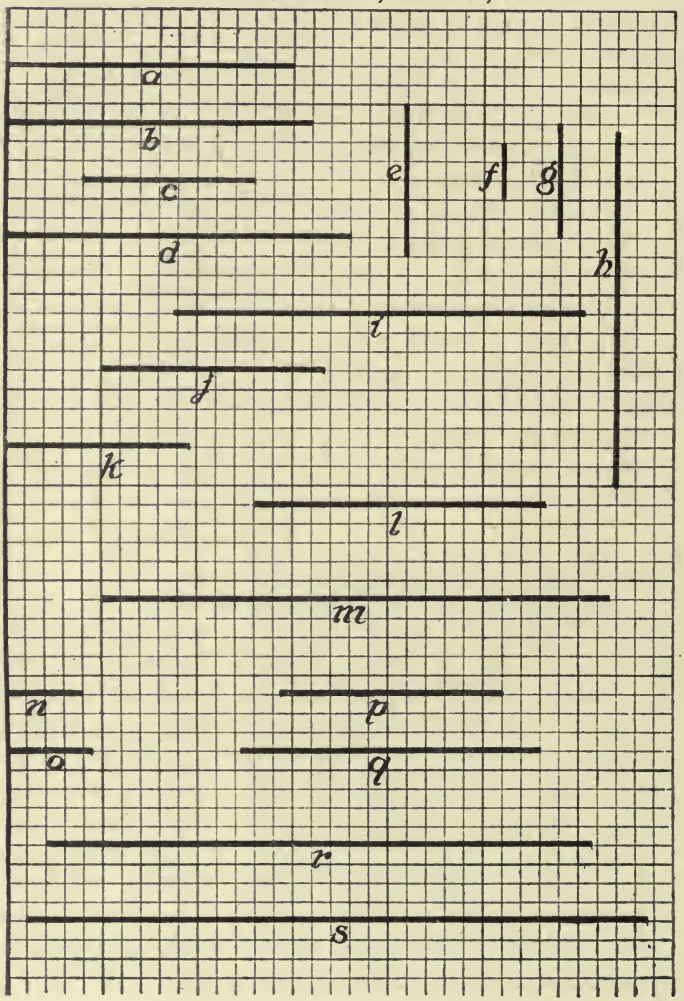
INCHES AND TENTHS OF INCHES



INCHES AND TENTHS OF INCHES

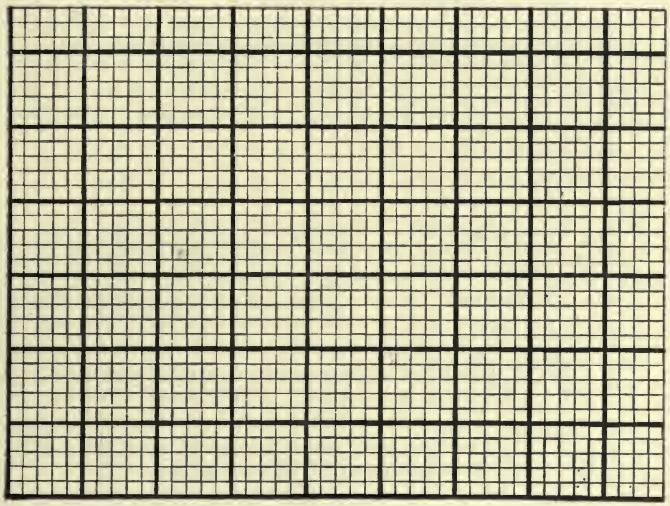
(1) Give the measures of the following lines correct to tenths of inches. See chart, page 226. By making estimates, give the approximate measures correct to hundredths of inches of those lines that are not even tenths.

(2) On such squared paper draw horizontal lines as follows: 2.3 in.; .6 in.; 1.4 in.; 1.45 in.; 1.2 in.; 1.23 in.; 1.25 in.; 1.28 in.



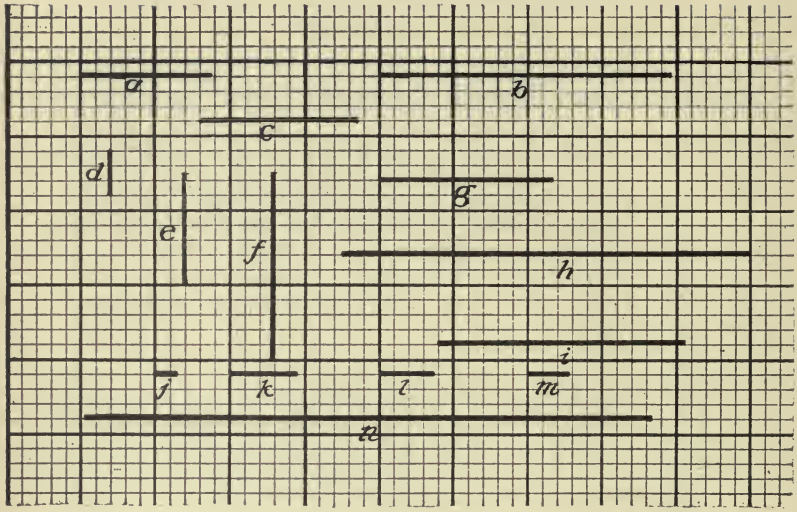
(3) Draw vertical lines as follows: .2 in.; 1.9 in.; 1.36 in.; 2.06 in.

(b) Another kind of graph or squared paper has the larger squares of one centimeter on a side in heavier lines. Since the millimeter is so very small, the lighter lines are usually 2 millimeters or .2 centimeters apart. Of course, one can easily estimate the point half way between these lines as .1 centimeter.

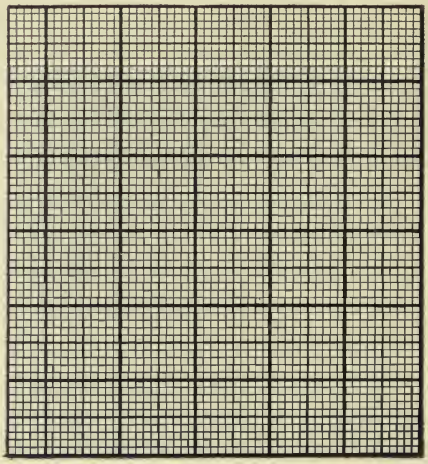


CENTIMETERS AND FIFTHS OF CENTIMETERS

1) Measure the following lines:



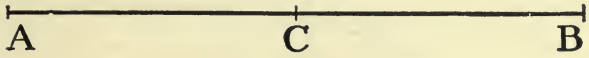
(2) On centimeter graph paper, draw lines as follows: 4 mm.; 1.7 cm.; 3.5 cm.; 1.2 cm.; 9 mm.; 5.6 cm.; 2.8 cm.; 3.1 cm.; 4.3 cm.; .3 cm.; 61 mm.; 3.4 cm.; 5.9 cm.; 7.7 cm.; 2.1 mm.



CENTIMETERS AND MILLIMETERS

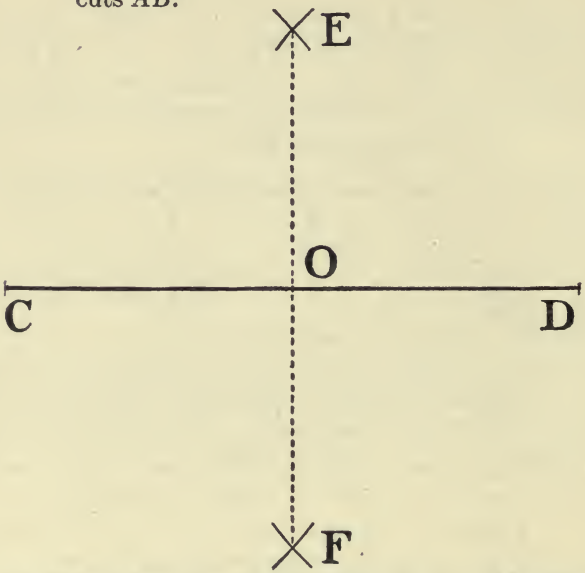
E. BISECTION OF LINES

1. (a) Draw a line 3 in. long, as the line AB.
   (b) How long is half of AB?
   (c) Measure $1\frac{1}{2}$ in. from A and mark the point C.
   (d) The point C is called the mid-point of the line AB and is said to bisect AB.



   (e) When a line is bisected, into how many parts is it cut?
   (f) How must these parts compare?
   (g) Put the sharp point of your compass on C, open it carefully until the lead point exactly touches A. In this way you measure AC with your compass.
   (h) Now, without lifting the sharp point, swing the lead around and make a mark on the other side of point C. Does this mark exactly pass through B? If so, your measurements have been very exact.
2. (a) Draw lines $2\frac{1}{4}$ in.; $3\frac{7}{8}$ in.; 4.7 cm.; 5.5 in. long.
   (b) Bisect each with your ruler and test each with your compass.
   (c) If your measurements are not exact, draw a number of other lines and practice bisecting them.
3. (a) Draw a line 3 in. long, as CD.
   (b) Put the sharp point of your compass on C. Open the compass a little over half of CD. Make a mark above the middle of CD, and without lifting the point make another below the line. Now place the point on D, but be very careful not to change the opening of the compass, and make two marks which cut the first two, as at E and F. Draw a dotted line very carefully so that it passes exactly through the points E and F. Put

the letter O at the point where the dotted line cuts AB.



(c) Now place the sharp point on O. Measure OC, swing the compass around and make a mark on the other side. Does it pass through D? If so, your work is accurate and AB is bisected with a compass. If not, where was your error?

(1) Was your pencil very sharp or did it make too broad a line?

(2) Did you place the sharp point of the compass exactly on C and on D? If it was the width of a pencil line off of the point, your drawing could not be exact.

(3) Did your dotted line pass through E and F exactly? It is very difficult to draw a line exactly through two points or intersections of two lines. The ruler must be so placed as to allow for the width of the pencil line, so it and not the edge of the ruler will pass through the two points.

(d) Draw the following lines and bisect them with a compass:

(1) $5\frac{5}{8}$ in.	(5) 8.7 cm.
(2) $6\frac{3}{4}$ in.	(6) 10.3 cm.
(3) $4\frac{15}{16}$ in.	(7) 4.8 cm.
(4) $2\frac{11}{16}$ in.	(8) 7.9 cm.

(e) Test your results for accurate work,

(1) With your ruler.

(2) With your compass.

(f) Which gives the better test? Why?

(g) Draw six lines of unknown or indefinite length. Bisect each and test results.

F. ANGLES

1. (a) Very carefully fold a sheet of smooth paper. Fold it in any direction, but crease the fold smooth and flat.

(b) Fold a second time, being careful that the two edges of the first fold come together exactly.

(c) This folded paper makes a square corner. Fit it into the corner of the page of your book.

(d) Use the figure in Ex. 3 (a) of Section E, and fit the folded paper into the corner at O made by the two lines CD and EF. Does it fit?

(e) How many such corners can you find in this figure? Does it fit each of them?

(f) Try fitting it into the other drawings you made in Ex. 3 (d) and 3 (g) of Section E.

2. (a) Unfold your paper and you will find the two lines of the folds crossing each other, as CD and EF intersect in Ex. 3 (a).

(b) In each case you have four corners or angles. Since your folded paper fitted into all the corners, we say that all the corners are the same kind or are equal.

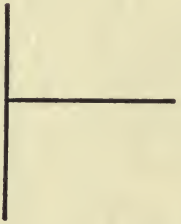
3. (a) Fold a piece of paper once as before.
   (b) Now fold it again, but do not put the two edges together.
   (c) Unfold the paper and examine the corners or angles.
   (d) Is the number the same as before?
   (e) Are these corners or angles all alike or equal?
   (f) Does any one of them make a square corner?
   (g) What must be true of these angles if they make a square corner?
   (h) When two lines cross each other so that the four angles around the point of intersection are all equal, the angles are called *right angles*.

Four Right Angles

Right Angle

Right Angle

Two Right Angles



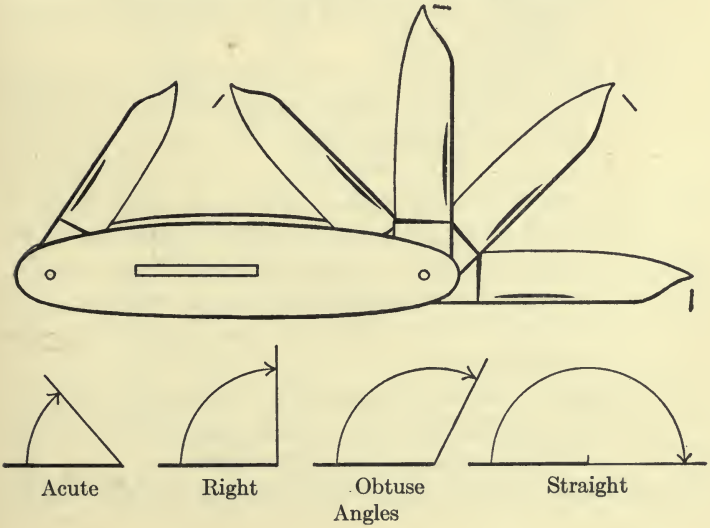
Two Right Angles

Two Right Angles

   (i) Unfold the paper prepared in **3** (a) and **3** (b). Are there any two of these angles that fit each other or are equal? How many pairs of equal angles do you find? Can you find two angles whose corners are less than a right angle? Compare the other two with a right angle.

(j) When the blade of a penknife is open slightly, it makes a sharp angle with the handle. Before it is half way open, the opening or angle is less than a right angle. Such an angle less than a right angle is called an *acute angle.* It means a sharp angle. When the blade is just half way open, it makes a right angle. As it is opened farther the angle grows greater than a right angle and more blunt at the hinge. Finally, the blade is opened completely through a second right angle, when blade and handle make a straight line When the angle is blunt, that is, when it is greater than a right angle and before it makes two right angles, it is called an *obtuse angle.* Obtuse means blunt.

As soon as the blade passes through two right angles, that is, when it is completely open and the blade and handle form a straight line, the blade and handle form a *straight angle.*



(k) Every hour the minute hand of a clock makes one complete turn around the face.

Through how many right angles does it turn or rotate?

After it leaves its original position at 12, through what kind of an angle is it turning the first 15 minutes?

When does it turn a right angle?

Through what kind of an angle does it turn during the second quarter of the hour?

When does it turn through a straight angle?

G. ANGLE MEASURES

1. (a) From your folded paper you have seen that all the space around a point may be divided into four right angles. So a right angle is sometimes used to measure other angles, just as a foot rule or meterstick may be used to measure lengths. But we find that a right angle is a rather large unit of measure, as a yard stick is rather long for measuring short lines.

(b) We can measure the rotation of the minute hand of the clock by quarter-hours, but unless we had smaller units than these, we could not tell or measure time very exactly. The clock face is further divided into twelfth-hours, that is, units of five minutes each, and still further into units of one minute. How many minute units does the minute hand pass through in one rotation or in one hour? How accurately can you tell time with these units?

(c) In the same way the space around a point is divided into 360 small spaces, each one called a *degree*. 360 degrees may be written 360°.

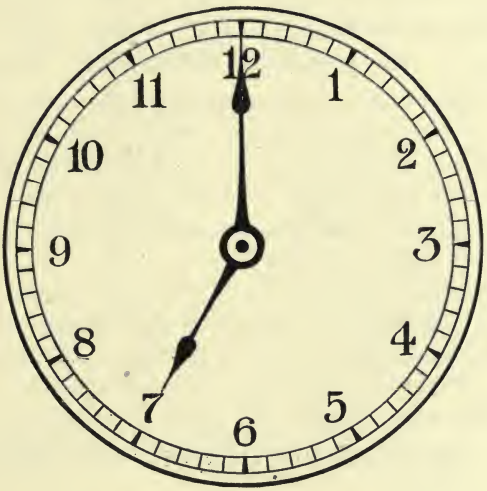
(d) What part of the whole space is a right angle?

Therefore, a right angle has how many degrees? How many degrees are in a straight angle?

2. (a) Through how many degrees does the minute hand pass in turning around the clock once?

(b) How many minutes of time does one turn make?

(c) How many degrees are there in one minute of time? In five minutes? In ten minutes? What kind of angles are these?



(d) How many degrees are there in fifteen minutes? What kind of angle is made in fifteen minutes?

(e) How many degrees are there in twenty minutes? In twenty-five minutes? What kind of angles are these?

(f) How many degrees does the hand turn in thirty minutes? What kind of angle is made?

(g) The minute hand keeps on turning still more after the half-hour point is reached. That is, it keeps on making angles that are larger than a straight

angle. How many degrees does the hand turn in thirty-five minutes? In forty-five minutes? In fifty minutes?

(h) Find the number of degrees the minute hand turns through in each of the following numbers of minutes of time?

(1) 10 min.	(6) 29 min.	(11) 48 min.	(16) 56 min.
(2) 18 min.	(7) 8 min.	(12) 31 min.	(17) 22 min.
(3) 32 min.	(8) 16 min.	(13) 12 min.	(18) 59 min.
(4) 24 min.	(9) 45 min.	(14) 4 min.	(19) 30 min.
(5) 15 min.	(10) 42 min.	(15) 44 min.	(20) 60 min.

(i) Which angles are nearer one right angle than two right angles? What kind of angle is each?

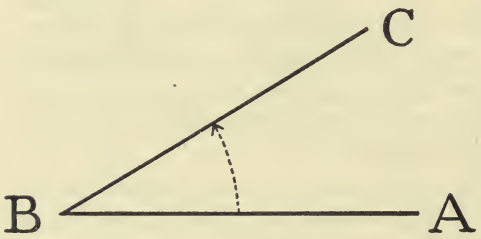
(j) Which angles are nearer two right angles than either one right angle or three right angles? Which ones are less than a straight angle? What kind of angles are these?

(k) Which angles are nearer three right angles?

(l) Which angles are near four right angles?

(m) Which angles are greater than a straight angle? Which are less than a straight angle?

3. (a) What is an angle? An angle is the *amount of turning* a line makes as it turns on a flat surface about a point.

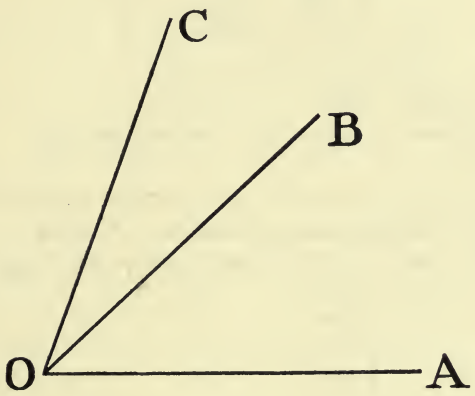


(b) An angle may be drawn on paper by showing the position of the line before it starts to turn and

its position when it stops. One end of the line remains exactly fixed at the point about which the line turns. This fixed point as B is called the *vertex* of the angle. The two lines AB and BC are the sides.

(c) The angle in the figure is the angle ABC. It may be named the angle B. If the three letters are used to name it, which point is in the middle?

(d) Sometimes we may have two or more angles at the same point or vertex. How many angles can you find at the point O in this figure?



Read the angles with three letters.

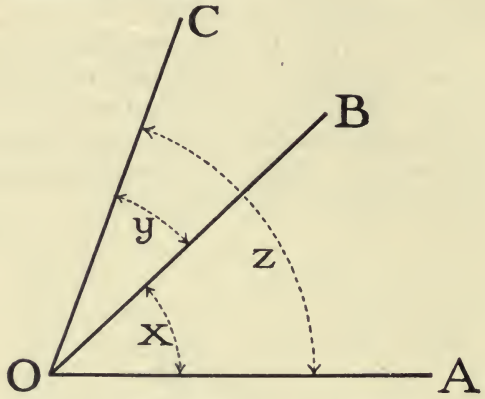
(e) Does the name angle O tell you which angle is meant?

(f) How many found two angles? How many found three angles? Study the figure until you find three angles.

4. (a) We find, therefore, when there are two or more angles at one vertex, the vertex letter which belongs to all of the angles cannot be used to name several distinct angles.

(b) Is an angle definitely named by using three letters?

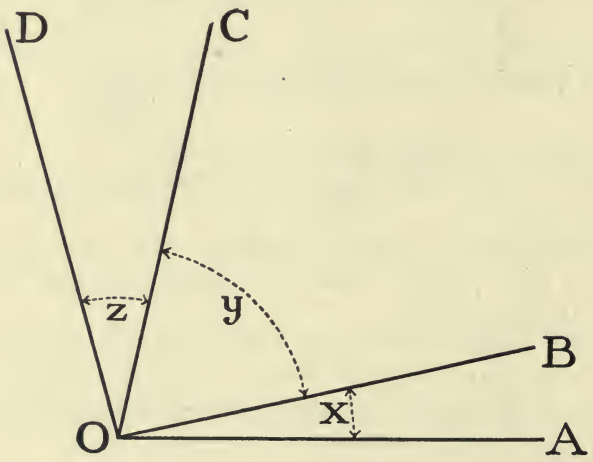
(c) Sometimes it is more convenient to name such angles with a single small letter which is written within the angle.



(d) Read the angle x with its full name of three letters.

(e) Read the full name of angle y. Of angle z.

5. (a) How many angles can you find in this figure?



(b) Read each one with its short name and with its full name.

(c) Can you find six angles at the point O? Study the figure until you find six angles

(d) Draw a figure like this one and draw dotted lines with arrow heads to show the other three angles. Mark them u, v, and w. Read each one in two ways.

6. (a) Some rulers have besides their scales for measuring inches and centimeters, a semicircular scale for measuring angles. Sometimes the angle scale is made as a separate tool. It is called a *protractor*.

(b) A ruler that has both the linear scale and the angle scale is called a *combination ruler and protractor*. Such a combination ruler made of celluloid is more satisfactory than the two separate tools or instruments.

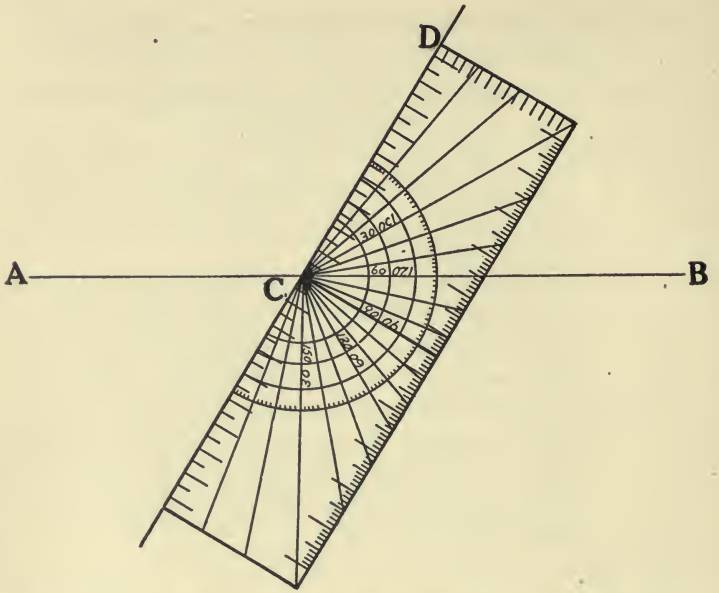
A Protractor and its Use

7. There are many kinds of protractors but the most satisfactory kind is a combined ruler and protractor. It should be made of celluloid because of its transparency. One edge of the ruler should be marked in English units and the other in metric units. One end should be marked in tenths of inches.

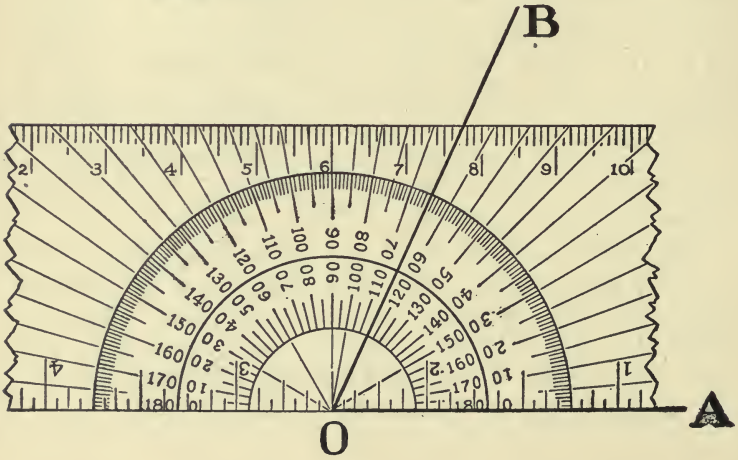
The Granville Combined Ruler and Protractor has one end marked in fiftieths of an inch and its width is exactly the square root of 2 inches.

The following figure shows how to draw an angle of 60°.

Given any line AB. Select some point, C, in the line and place the center of the protractor at this point. Slide the protractor around until its 60° line exactly coincides with AB Then draw a line along the edge CD. $\angle BCD$ is a 60° angle.



8. (a) This figure shows how to use a protractor in measuring the number of degrees in an angle, as the angle AOB.



(b) The center of the protractor is placed on what point of the angle?

(c) The edge of the protractor which is marked zero degrees, 0°, is placed on the side OA.

(d) Between what two numbers of degrees on the outer row of figures does the line OB lie? Count the tiny degree spaces from the nearest number to the line OB. How many degrees are in the angle AOB?

9. (a) Draw ten or more angles of different sizes.

(b) Use your protractor to measure each.

(c) Tell which kind of angle each is.

H. PERPENDICULAR LINES

1. In Ex. 3 (a) of Section E, you learned how to bisect a line with a compass. If a new pupil came to your class, how would you explain to him the way to bisect a line?

2. (a) What kind of angles does the bisecting line make with the original or given line?

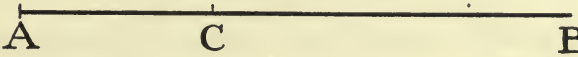
(b) Measure these angles with your protractor.

(c) Two lines that meet in such a way that they make two equal angles are *perpendicular* to each other. The two equal angles are *right angles.*

3. When you learned to bisect a line, you also learned to draw or construct the *perpendicular bisector* of a line.

4. (a) Sometimes we wish to draw a perpendicular to a line at a point other than the midpoint.

(b) For example, you may wish to draw a perpendicular to the line AB at the point C, which is not the midpoint.



(c) To draw such a perpendicular to AB at point C, follow these directions:

(1) Place the sharp point of the compass on C, having the compass open any distance not greater than the shorter part of AB.
(2) With the compass mark off this distance on each side of point C.
(3) Mark these intersections on AB, as E and F
(4) Open the compass a little wider. Put the sharp point on E and make a mark above C. Then put the point on F, keeping the same opening of the compass, and make a mark crossing the first one.
(5) Letter the point where the two marks cross as P.
(6) Draw a line through the two points P and C.
(7) Is this line PC perpendicular to AB?
(8) How can you prove it?

5. (a) With your protractor, make a right angle at point C in the line AB.
   (b) What is the relation of one side of a right angle to the other?
6. (a) Draw a horizontal line.
   (b) Draw a vertical line.
   (c) Draw an oblique line.
   (d) Draw a line that meets the horizontal line so as to make right angles with it. Which of these lines is perpendicular to the other?
   (e) Draw a perpendicular to the vertical line. What kind of angles are made at the point where the two lines meet? Why?
   (f) Draw a perpendicular to the oblique line. How do you know these lines are perpendicular to each other?
   (g) When is a perpendicular line also a vertical line?

(h) When is a perpendicular line also a horizontal line?

(i) When is a perpendicular line also an oblique line?

7. (a) Draw a line and call it MN.

(b) Mark any two points in the line as A and B.

(c) At point A draw a line perpendicular to MN. Call this perpendicular AC.

(d) At point B draw a perpendicular to MN and call it BD.

(e) Can the lines AC and BD ever meet or intersect? Can you make them long enough so that they will intersect?

(f) Since AC and BD both make right angles with MN, we say they have the same direction.

8. (a) Draw another line as PQ and mark two points in it as A and B.

(b) At A draw a line AX which makes an angle of 50° with PQ.

(c) At B draw a line BY which makes an angle of 50° with PQ.

(d) Can AX and BY ever meet?

(e) Do they take the same direction from PQ?

9. (a) Draw a pair of lines that make angles of 30° with a given line.

(b) Do they have the same direction?

10. (a) What angle does a street running east and west make with another street which runs due north and south?

(b) At what angle does a street running northeast meet a street running east and west?

(c) If two streets run southeast, do they have the same direction? Do they ever meet?

11. (a) When two lines have the same direction they are *parallel*.

(b) Two lines have the same direction when they make _____ angles with another line.

(c) Parallel lines can not _____.

12. (a) Pick out twenty pairs of perpendicular lines in your room.

(b) Pick out twenty pairs of parallel lines in your room.

(c) What would happen if the two sides of a door were not parallel? If the two sides of a window frame were not parallel?

(d) What would happen if the edge of the door were not perpendicular to bottom?

(e) What would happen if the door frame were not perpendicular to the floor?

13. Divide the class into two teams, one on perpendiculars and one on parallels. Let each team try to prove that its kind of lines is of more importance than the other.

I. SQUARES AND RECTANGLES

1. (a) Draw a line, AB, 1 in. long.

(b) At the point A, make a right angle with your protractor.

(c) Measure AB with your compass and on the perpendicular mark off a line AC equal to AB.

(d) How do the two sides of this right angle compare in length?

(e) Without changing the opening of the compass, put the sharp point on B and make a mark directly above B. Then put the sharp point on C and make a mark cutting the other one. Call the point where these two marks intersect the point D.

(f) Draw the lines from C to D and from B to D.

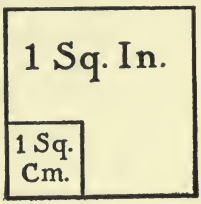
(h) How many lines are in the figure?

(i) With your compass compare each line with the line AB.

(j) With your protractor measure the angles at points A, B, C, and D.

(k) What kind of angles are they?

(l) What kind of figure is made?



2. (a) Draw a long line of indefinite length MN.

(b) Beginning at M, mark off a length MO equal to the side AB of the above square. Then from O, measure on the line another length OP equal the side BD. Continue by marking off PQ equal to DC and QR equal to AC.

(c) Measure the length of MR. The length MR measures the distance around the square, i.e., it measures the *perimeter* of the square.

3. (a) On graph paper draw a square 1.8 inches on a side.

(b) Draw a line that is equal to the perimeter of this square.

(c) How long is the perimeter?

(d) How does the perimeter compare with one side of the square?

(e) The perimeter of a square ———— times the side of a square.

4. Draw squares whose sides are the following lines:

(a) $2\frac{1}{8}$ in.	(e) 1.9 cm.	(i) 1.125 in.	(m) 1.6 cm.
(b) 1.3 cm.	(f) $\frac{3}{4}$ in.	(j) 4.65 cm.	(n) $\frac{15}{16}$ in.
(c) $\frac{5}{8}$ in.	(g) 1.25 in.	(k) 3.7 cm.	(o) $1\frac{3}{8}$ in.
(d) 1.2 in.	(h) .875 in.	(l) 2.625 in.	(p) .375 in.

5. What is the length of the perimeter of each of these squares?

6. (a) On graph paper draw a square whose side is 1 in. The area of this square is a square inch.

(b) At the side of this square and adjoining it, draw another square the same size.
(c) How many square inches are in this figure?
(d) Draw a square two inches on a side.
(e) How many square inches are in this figure?
(f) What is the difference between two square inches and two inches square?

7. (a) Draw a rectangle 3 in. long and 2 in. wide.
(b) In what way is a rectangle like a square?
(c) In what way is it different?
(d) Is it correct to say that a square is a rectangle whose sides are equal?
(e) How many square inches are in the area of the rectangle 3 in. long and 2 in. wide?
(f) Draw the following rectangles and find the number of square units in their areas: six inches long and one inch wide; four inches long and one and a half inches wide.
(g) Draw a figure whose area is 6 square inches.
(h) Draw a figure which is 6 inches square.
(i) Which is the larger and how much?

8. (a) Which is the larger, $\frac{1}{2}$ inch square or $\frac{1}{2}$ square inch?
(b) On graph paper draw a picture to represent each and count the number of small squares in them to check your conclusion.

9. Compare and explain the difference between the following:

(a) 3 ft. square and 3 square ft.
(b) $\frac{1}{3}$ ft. square and $\frac{1}{3}$ sq. ft.
(c) 4 in. square and 4 sq. in.
(d) $\frac{1}{2}$ in. square and $\frac{1}{2}$ sq. in.
(e) 5 cm. square and 5 sq. cm.
(f) $\frac{1}{5}$ cm. square and $\frac{1}{5}$ sq. cm.

10. (a) On graph paper, based on the centimeter, shade $\frac{1}{5}$ cm. square; $\frac{1}{5}$ sq. cm.

(b) Which is the larger? How many times larger?

11. (a) Since a square made on a line 3 in. long contains 3×3 or 9 sq. in., we say that 9 is the square of 3; that is, $9 = 3 \times 3$. How many times is the factor 3 used in its square?

(b) Again $5 \times 5 = 25$. Therefore, 25 is the square of 5. How many times is the factor 5 used to make 25?

(c) When any number is multiplied by itself, it is used as a factor twice, and the product is the square of the number.

(d) Sometimes $5 \times 5 = 25$ is written as $5^2 = 25$. The last statement is read "five square equals twenty-five." The small 2, written to the right and a little above the 5, shows that it is used twice to make the product, as $5^2 = 5 \times 5 = 25$.

(e) Find the following products. Where possible use the short cuts given in Chapter One.

(1) 4^2	(6) 22^2	(11) 75^2	(16) 100^2
(2) 3.5^2	(7) $(\frac{3}{4})^2$	(12) $(\frac{1}{16})^2$	(17) 25^2
(3) 11^2	(8) 15^2	(13) 20^2	(18) 16^2
(4) $(6\frac{1}{2})^2$	(9) $(\frac{2}{5})^2$	(14) $.2^2$	(19) $(\frac{1}{16})^2$
(5) 9^2	(10) 95×95	(15) $.01^2$	(20) 8.5^2

12. (a) On graph paper draw a figure which represents 4^2.

(b) Draw three of these figures side by side joining each other. This figure represents 3×4^2. How many small squares are included in the figure?

(c) If you were asked to find the value of 3×4^2, would it be correct to multiply 3 by 4 and square the product 12? Draw a figure to represent $(3 \times 4)^2$ or 12^2.

(d) Which is the larger, 3×4^2 or $(3 \times 4)^2$? How many times as large?

13. (a) A square has a side 2 in. long. How many square inches are there in 3 such squares?

(b) Make a square whose side is 3 times as long as the first square. Find its area.

(c) Which is the larger?

(d) How many times as large is it?

14. Find the values of the following:

(a) $\frac{1}{2} \times 6^2$	(h) $6^2 \times 7\frac{1}{2}$	(o) $(\frac{3}{5} \times 15)^2$
(b) $(\frac{1}{2})^2 \times 6$	(i) $(6 \times 7\frac{1}{2})^2$	(p) 2.5×3.5^2
(c) $(\frac{1}{2} \times 6)^2$	(j) $\frac{1}{3} \times 9^2$	(q) $2.5^2 \times 3.5$
(d) 5×8^2	(k) $(\frac{1}{3})^2 \times 9$	(r) $(2.5 \times 3.5)^2$
(e) $5^2 \times 8$	(l) $(\frac{1}{3} \times 9)^2$	(s) $.1 \times .01^2$
(f) $(5 \times 8)^2$	(m) $\frac{2}{5} \times 15^2$	(t) $.1^2 \times .01$
(g) $6 \times (7\frac{1}{2})^2$	(n) $(\frac{3}{5})^2 \times 15$	(u) $(.1 \times .01)^2$

15. (a) To find the perimeter of a square, how many dimensions must you know?

(b) In 3 (e), we made the following statement: The perimeter of a square equals four times its side.

(c) Suppose we abbreviate this statement by using the initial letters for the words perimeter and side and signs for the other words. A small square, □, may be used in place of the word.

$$P\square = 4 \times s$$

When a statement is written in such a shorthand form, it is called a formula.

If the side of a square is 3″, then its perimeter may be found by putting 3″ in place of s. Thus:

$$\begin{aligned} P\square &= 4 \times s \\ &= 4 \times 3 \\ &= 12'' \end{aligned}$$

Read the last statement as an English sentence. $4 \times s$ may be written as $4s$, just as we write 3 ft.

(d) Find the perimeters of the following squares, when s is:

(1) 2 in.	(8) 10.8 cm.	(15) 30.7 cm.
(2) $7\frac{1}{2}$ cm.	(9) 12 ft.	(16) $16\frac{1}{2}$ ft.
(3) 6.5 ft.	(10) 15 cm.	(17) 8.3 cm.
(4) 3.6 cm.	(11) 1 ft. 4 in.	(18) 1 ft. 10 in.
(5) .9 in.	(12) 2 ft. 6 in.	(19) 4 rd.
(6) $5\frac{1}{2}$ yd.	(13) 18 in.	(20) 4 rd. 6 ft.
(7) 23 cm.	(14) 2.9 cm.	(21) 6 ft. 9 in.

16. (a) How can you find the area or surface of a square from the side?

(b) If S means surface and s means the length of the side of a square, what does this formula mean?

$$S\square = s^2$$

(c) What is the value of S if s is 3?

$$\begin{aligned} S\square &= s^2 \\ &= 3^2 \\ &= 9 \text{ sq. in.} \end{aligned}$$

(d) Why is it necessary to write sq. in. after the 9?

(e) Find the area of a square when s is 5 in.; $3\frac{1}{2}$ cm.; $\frac{1}{2}$ ft.

(f) Find the areas of the squares given in Ex. 15 (d). Use the formula in each.

17. (a) To find the perimeter of a rectangle, what dimensions must you know?

(b) Draw a rectangle 4 in. by 3 in. With a pencil trace half way around the rectangle. How far has your pencil traced? Trace the rest of the perimeter. How many times did you trace the length? How many times did you trace the width?

(c) Does the perimeter equal $(2 \times 4) + (2 \times 3)$?

(d) Does the perimeter equal $2(4 + 3)$?

(e) Does the perimeter equal two times the length plus two times the width?

(f) Can you read this shorthand formula?

$$P\square = 2l + 2w$$

(g) Does the perimeter equal two times the sum of the length and width?

(h) Is this shorthand formula correct?

$$P\square = 2(l + w)$$

(i) Show that both formulas for the perimeter of a rectangle are correct by finding the perimeters of the following rectangles:

No.	Length	Width
(1)	5 in.	2 in.
(2)	8 ft.	3 ft.
(3)	6 cm.	4 cm.
(4)	$7\frac{1}{2}$ in.	3 in.
(5)	12 in.	$8\frac{1}{2}$ in.
(6)	$16\frac{1}{2}$ ft.	$5\frac{1}{2}$ ft.
(7)	9.4 cm.	6.6 cm.
(8)	15.3 cm.	9.2 cm.
(9)	$\frac{3}{4}$ in.	$\frac{1}{2}$ in.
(10)	$\frac{15}{16}$ in.	$\frac{5}{8}$ in.

18. (a) If a rectangle is 4 in. long and 3 in. wide, how many sq. in. are in its area or surface?

(b) How can you find the area or surface of any rectangle from its length and width?

(c) Is this formula correct?

$$S\square = l \times w$$

(d) What does it mean?

(e) Find the area, S, when l is 8 in. and w is 5 in.

$$\begin{aligned} S\square &= l \times w \\ &= 8 \times 5 \\ &= 40 \text{ sq. in.} \end{aligned}$$

(f) Why was it necessary to write sq. in. after 40?

(g) Use the formula to find the areas of the rectangles given in Ex. 17 (i).

19. (a) What happens to the perimeter of a square if its side is doubled?
    (b) What happens to its area?
20. (a) What happens to a square if its side is made 3 times as large? 4 times? 10 times? $\frac{1}{2}$ as large?
    (b) What happens to its area?
21. (a) What happens to the perimeter of a rectangle if its length is doubled but the width is not changed?
    (b) What happens to its area?
    (c) What happens to the perimeter if both the length and the width are doubled?
    (d) What happens to its area?
22 (a) Draw a square and one diagonal.
    (b) Cut out the square and cut along the diagonal.
    (c) Into what kind of figures has the square been cut?
    (d) Are these two triangles alike in shape and size?
    (e) By putting one on top of the other, can you make them fit?
    (f) How does the diagonal of a square divide it?
23. (a) Draw a rectangle and one diagonal.
    (b) Cut out the triangles thus made.
    (c) Can they be made to fit each other?
    (d) What conclusion do you draw?
24. (a) Many designs for linoleum and certain kinds of wall paper are made in squares and rectangles by drawing diagonals and lines parallel to the sides.
    (b) On graph paper draw the two diagonals in each of a block of 36 squares. The diagonals will divide each square into 4 triangles. In the first, third, and fifth squares of the top row, shade the upper and lower triangles. In the second, fourth, and sixth squares, shade the triangles at the sides

of the squares. Shade the other rows in the same way, but begin the second, fourth, and sixth rows by shading the triangles at the sides of the square, first.

(c) Such a design is one of the simplest of a great variety of designs based on the square. See if you can make a different design.

(d) Bring to class as many linoleum patterns as you can find that are based on the square or rectangle.

(e) By shading different parts or using different colors, a variety of designs may be produced from the same pattern.

(f) Drawing circles around the square or within the square, adds greatly to the possibilities of such designs.

(g) Make an original design either in black and white or in colors.

J. TRIANGLES—HEXAGONS

1. (a) By drawing a diagonal in a square, two triangles are formed.

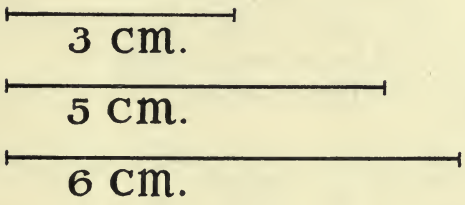
(b) What is the size of the largest angle in each triangle?

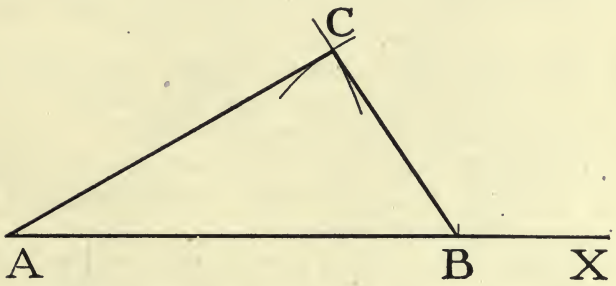
(c) What is the size of each of the smaller angles?

(d) How many sides in one of these triangles are equal in length? How do you know they are equal?

(e) Such a triangle made from a square is a special kind of triangle in two respects. First, it has one angle which is 90°; therefore, the triangle is called a right triangle. Second, it has two sides which are equal in length; therefore, it is called an *isosceles* triangle.

2. (a) By drawing the diagonal of a rectangle, two triangles are formed.
   (b) Is there a right angle in each of these triangles? Therefore, what kind of a triangle is it?
   (c) In each of these triangles are there any two sides equal to each other? Is it an isosceles triangle?
3. (a) Draw three lines 3 cm., 5 cm., and 6 cm. long respectively.





   (b) Using these lines for sides, make a triangle as follows:
      (1) Draw a line, as AX, of indefinite length but longer than 6 cm.
      (2) Use the compass, measure the line which is 6 cm. long, and on AX mark off AB equal to 6 cm.
      (3) Measure the line 5 cm. long. Put the

sharp point on A and make a mark above AB.

(4) Then measure the 3 cm. line; put the sharp point on B and make a mark cutting the first line. Letter their intersection C.

(5) Draw the lines AC and BC. Then ABC is a triangle whose sides are 3 cm., 5 cm., and 6 cm. respectively.

(c) What is the perimeter of this triangle? Draw one line that represents this perimeter.

(d) With your protractor, measure each of the three angles.

(1) Is any one of them exactly a right angle? Is it a right triangle?

(2) Is any angle greater than a right angle? If so, what kind of angle is it?

(3) Is any angle less than a right angle? What kind of angle is it?

4. (a) In like manner, draw a triangle whose sides are 4 cm., 5 cm., and 6 cm. respectively.

(b) Is this an isosceles triangle? Why?

(c) Measure each angle to see whether it is a right angle, or is greater than a right angle, or is less than a right angle.

(d) If all three angles of a triangle are less than a right angle, it is called an acute triangle.

5. (a) Draw a triangle 5 cm. on each side.

(b) Any triangle whose three sides are of equal length is an *equilateral triangle*. The word *equilateral* means *equal sided*.

(c) Measure the angles of this triangle. How do they compare in size?

(d) If the three angles of a triangle are equal, the triangle is *equiangular*.

6. (a) Draw a series of triangles with three sides equal, using any measures, as 7 cm., $1\frac{1}{2}$ cm., $2\frac{1}{4}$ in., 3.8 cm., 3 in.

(b) Measure the size of the angles in each of these triangles.

(c) What kind of triangle is each?

7. (a) Draw triangles whose sides have the following lengths. In each case draw the three lines of the given lengths first; then construct the triangle.

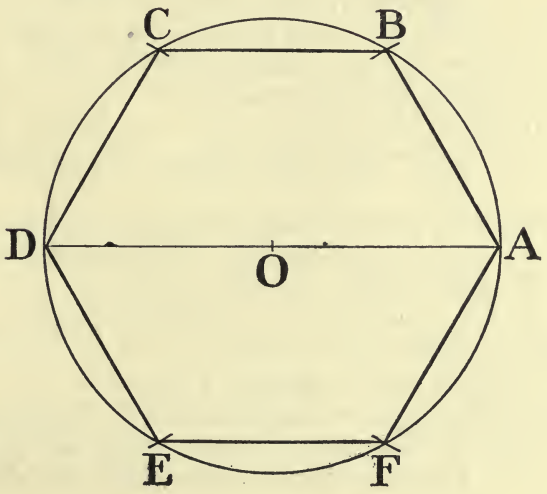
(1) 4 cm., 5 cm., 7 cm.
(2) 3 cm., $4\frac{1}{2}$ cm., 7 cm.
(3) $1\frac{1}{2}$ in., $2\frac{1}{2}$ in., $3\frac{1}{2}$ in.
(4) 3 in., 3 in., $4\frac{1}{2}$ in.
(5) $1\frac{7}{8}$ in., 3 in., $4\frac{1}{4}$ in.
(6) 3.6 cm., 5.2 cm., 8 cm.
(7) 4.2 cm., 7 cm., 9.3 cm.
(8) $6\frac{1}{2}$ cm., $6\frac{1}{2}$ cm., $6\frac{1}{2}$ cm.
(9) $4\frac{1}{2}$ cm., $4\frac{1}{2}$ cm., 7 cm.
(10) 4 in., $2\frac{1}{4}$ in., $2\frac{1}{4}$ in.

(b) Find the perimeter of each triangle.

(c) Measure the angles of each triangle.

(d) Tell the kind of triangle each is.

8. (a) Draw a circle and a horizontal diameter, as in the figure.



(b) The *radius* of a circle is the distance from the center to the circle.

(c) A *diameter* is a line drawn through the center of a circle. How does the diameter compare with the radius in length?

(d) Put the sharp point of the compass on A, and with the same opening as the radius, make marks intersecting the circle at B and F.

(e) Put the point on D and, using the same opening or radius, make the marks at C and E.

(f) Connect these points in succession by drawing straight lines.

(g) By using the compass, compare these lines in length.

(h) How many sides has this figure, *ABCDEF*?

(i) With your protractor measure the angles *ABC*, *BCD*, *CDE*, etc. How do they compare in size?

(j) This figure, with six equal sides and six equal angles is a regular *hexagon*. This word comes from the Greek and means *six angles*.

(k) Draw the other diameters BE and CF. Do they pass through the center O?

(l) What kind of figures have been made in the hexagon? How many figures? Compare them in size.

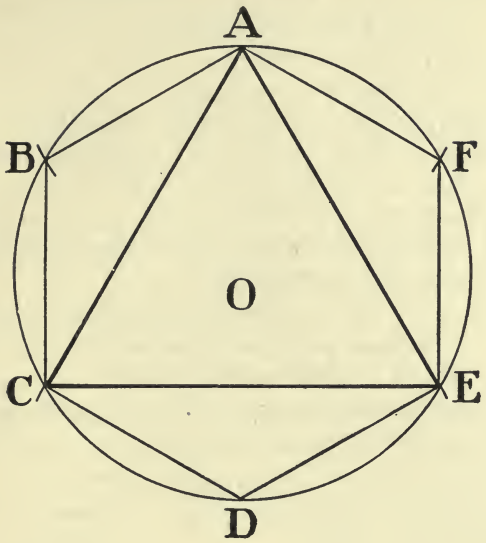
9. (a) Draw another hexagon in a circle. Mark the ends of a vertical diameter but do not draw the line.

(b) Draw the lines AC, CE, and AE.

(c) Use a compass and compare the lengths of these lines.

(d) What kind of figure is *ACE*?

(e) What kind of triangles are *ABC*, *CDE*, and *AFE*? How do they compare in shape and size? (If necessary, cut one out and fit on the others.)



(f) From *O* draw the lines *OA*, *OC*, and *OE*.

(g) They are three radii of the circle. Why? (The plural of radius is radii.)

(h) How do the radii compare with the sides of the hexagon?

(i) Into how many triangles is the hexagon divided? Are these triangles all equal?

(j) How many of the small triangles are in the larger triangle *ACE*?

(k) The hexagon is ..... times as large as the triangle *ACE*.

10. (a) Draw a circle and mark the points for a hexagon, but do not draw its sides.

(b) Draw the triangle *ACE*.

(c) In like manner draw the lines *BD*, *BF*, and *DF* to make the triangle *BDF*.

(d) What kind of figure is made within the triangles by the parts that overlap?

(e) Are its sides all equal?

(f) Measure each of its angles.

(g) How do they compare with each other?

(h) How do they compare with the angles of the hexagon as measured in Ex. 8 (i)?

11. (a) The hexagon and the triangle, either in circles or not, are used in designs more, perhaps, than any other kinds of figures.

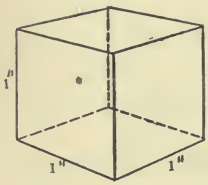
(b) Look for these designs, not only in linoleum and wall-paper patterns, but also in church windows and in decorations on buildings.

(c) Make several designs, based on the hexagon and the triangle in a circle.

K. SOLIDS

1. (a) What is a cube?

(b) How many dimensions has a cube? Name them. How do they compare?



(c) What is the shape of each face?

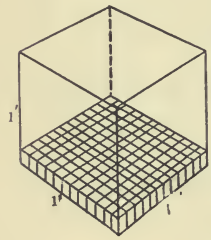
(d) How many faces are there?

2. How does an oblong block differ from a cube?

(a) As to dimensions?

(b) As to number of faces?

(c) As to the shapes of its faces?



3. How can you find the number of square inches in the entire surface of a 3″ cube? A cube 5 cm. long? 1 in. long? $7\frac{1}{2}$ in. long?

4. (a) A cube 1 in. long is called a *cubic inch.*

(b) A cube 1 cm. long is a *cubic centimeter.*

(c) A cube 1 ft. long is a *cubic foot.*

(d) What should you call a cube which is 1 yd. long? 1 meter long?

5. (a) If a box in the shape of a cube is 1 ft. long, we say that its volume is 1 cubic foot (1 cu. ft.).

$$\text{Volume} = 1 \times 1 \times 1 \text{ cu. ft.}$$
$$= 1 \text{ cu. ft.}$$

(b) If this box were measured in inches, we should find its volume in the same way, using 12 in. for each foot, thus:

$$\text{Volume} = 12 \times 12 \times 12 \text{ cu. in.}$$
$$= 1728 \text{ cu. in.}$$

6. (a) In measuring the amount of earth removed in excavating for the foundations of a house or building, we usually use the cubic yard as a unit of measure. How many cubic feet are in a cubic yard?

$$\text{Volume} = 1 \times 1 \times 1 \text{ cu. yd.}$$
$$= 3 \times 3 \times 3 \text{ cu. ft.}$$
$$= \ldots\ldots\ldots \text{ cu. ft.}$$

7. (a) If a cubical box, one foot on a side, is doubled in length but remains 1 ft. wide and 1 ft. high, how has the area of the base increased?

(b) How has the volume increased?

(c) How many cubic feet does the box contain?

(d) How many cubic inches?

(e) What is the shape of the box? Of the base?

(f) If the length is doubled and the width is doubled, but the height remains one foot, how has the area of the base increased?

(g) How has the volume increased?

(h) How many cu. ft. does the box contain?

(i) How many cu. in.?

(j) What is the shape of the box? Of the base?

(k) If the length, width, and height of the box are all doubled, how has the area of the base increased?

(l) How has the volume increased?

(m) How many cu. ft. does the box contain?

(n) How many cu. in.?

(o) What is the shape of the box? Of the base?

8. (a) Any object that has six sides, each of which is a rectangle, is a *rectangular prism*. Name objects in your room that resemble a rectangular prism.

(b) Are all of the boxes mentioned in Ex. 7 rectangular prisms? Is the cubical box given in Ex. 5 such a prism? Why?

(c) How many dimensions has every rectangular prism? What are they?

(d) How can the volume of a rectangular prism be found from its dimensions?

(e) How is the volume increased if one dimension is doubled? If two dimensions are doubled? If three dimensions are doubled?

(f) How is the volume increased if one dimension is trebled? If two dimensions are trebled? If three dimensions are trebled?

9. (a) A farmer's corn crib measures 8 ft. long, 6 ft. wide, and $4\frac{1}{2}$ ft. high. How many bushels of corn does it contain? A bushel contains approximately $1\frac{1}{4}$ cu. ft.

(b) He made a larger crib 8 ft. by 6 ft. by 9 ft. Without computing the volume tell how many bushels the new crib can hold.

(c) His neighbor has one 8 ft. $\times$ 12 ft. $\times$ 9 ft. Compare his corn crib in capacity with each of the others.

(d) Did you have to find the volume of the neighbor's crib?

10. A man is building a new house, whose foundation is 52 ft. long and 30 ft. wide. His cellar is to be $8\frac{1}{2}$ ft. high, but only $4\frac{1}{2}$ ft below the ground level. How much will the excavation cost at \$ .75 a cu. yd.?

11. (a) Did you make your calculation in Ex. 10 in the longest or the shortest way?

(b) Did you first multiply 52 by 30 by $4\frac{1}{2}$; then reduce the number of cubic feet to cubic yards; and then find the cost? If you did, you used the longest way.

(c) Did you first change each dimension from feet to yards; then find the number of cubic yards; and then find the cost? If you did, was your calculation shorter than the first?

(d) Did you merely indicate the change of each dimension from feet to yards; then indicate the product of the dimensions, but not actually multiply; and then find the cost? If you did, you used the shortest method.

(e) Compare the last method with the first two.

Given: Cellar, 52 ft. $\times$ 30 ft. by $4\frac{1}{2}$ ft.

Unit Cost, \$ .75 a cu. yd.

To find: Total cost.

Solution:

$$\text{Vol.} = \frac{52}{3} \times \frac{30}{3} \times \frac{4.5}{3} \text{ cu. yd.}$$

$$= \frac{52}{3} \times 10 \times 1.5 \text{ cu. yd.}$$

$$\text{Total Cost} = \frac{\cancel{3}}{\cancel{4}} \times \frac{\overset{14}{\cancel{52}}}{\cancel{3}} \times 15$$

$$= 14\ (14 + 1)$$

$$= 196 + 14$$

$$= \$\ 210$$

Such a solution includes all of the work, for no "scratch paper" has been necessary. It always pays to think through a solution first, to see how some work may be saved.

12. Find the cost of excavating for a basement of a building at \$1.50 a cu. yd. if it is 120 ft. long, 75 ft. wide, and 25 ft. deep.

13. (a) A cord of wood is a pile, cut in 4 ft. lengths, that is 8 ft. long and 4 ft. high. How many cubic feet are there in a cord of wood?

(b) How many cords are in a pile of wood 12 ft. long, 8 ft. wide and 8 ft. high?

(c) Did you make your calculations in the shortest way? Thus:

$$\text{No. of cords} = \frac{\overset{3}{\cancel{12}} \times \overset{2}{\cancel{8}} \times \cancel{8}}{\cancel{8} \times \cancel{4} \times \cancel{4}} = 6$$

(d) How many cords are in a pile of wood 20 ft. long, 8 ft. wide, and 6 ft. high?

14. (a) When architects plan school buildings, they calculate the cost per cubic foot. They figure what they call the cubage of the entire building, that is, the volume. If the cost per cubic foot runs too high, they plan to reduce the cubage in some way.

(b) From the given facts concerning schools in the following cities, calculate the cost per cubic foot. Arrange them in order of the cost of cubage.

All of these schools have been built since 1921.

(1) Find the cost of each school per cubic foot.

(2) Find the cost of each school per pupil to be accommodated, useing the cost of the building alone. Then compute the cost per pupil based on the total cost of the respective buildings.

(3) Which school cost the most per cu. ft.?

Name of City	Type of School	No. of Pupils	No. Cu. Ft. in Building	Cost of Building	
				Exclusive of Grounds and Equipment	Total Cost
Altoona, Pa.....	Jr. H. S.	2,000	2,862,208	$ 783,000	$1,026,000
Bayonne, N. J...	Jr. H. S.	3,000	3,000,000	1,127,000	1,400,000
Beloit, Wis.....	Jr. H. S.	600	790,907	214,459	257,912
Bethlehem, Pa...	Sr. H. S.	1,800	2,032,000	1,211,000	1,634,000
Bethlehem, Pa...	Jr. H. S.	800	443,000	323,000	376,000
Birmingham, Ala.	Sr. H. S.	1,500	2,727,218	700,000	903,075
Cincinnati, Ohio..	Jr. H. S.	1,600	1,893,000	856,411	984,548
Columbus, Ohio..	Sr. H. S.	2,000	3,050,000	818,311	1,025,392
Detroit, Mich....	Jr. H. S.	1,500	2,095,824	785,634	1,036,173
Everett, Mass....	Sr. H. S.	1,500	2,086,769	594,309	795,000
Harvard, Ill.....	Sr. H. S.	400	926,913	273,657	310,657
Lakewood, Ohio..	Sr. H. S.	500	925,000	356,000	392,000
Pueblo, Colo.....	Jr. H. S.	600	591,834	203,913	275,000
Rochester, N. Y..	Jr. H. S.	2,000	3,945,272	1,407,120	1,666,731
Somerville, Mass.	Jr. H. S.	1,404	1,276,213	483,759	600,000
Trenton, N. J....	Jr. H. S.	1,500	2,684,334	955,170	Not given
Trenton, N. J....	Jr. H. S.	1,900	3,063,735	1,002,735	Not given
Worcester, Mass..	Jr. H. S.	1,760	3,295,681	935,000	1,030,000

(4) Which one cost the least per cu. ft.?

(5) What is the difference in cost? What is the difference in per cent of cost?

(6) Which school cost the most per pupil to be accommodated?

(7) Which one cost the least per pupil?

(8) What is the difference in cost? In per cent of cost?

(9) Find the number of cubic feet in each building per pupil.

(10) Which school has the greatest number of cubic feet per pupil? Which one has the least number?

(11) Based on cubage costs, is it cheaper to build large schools or smaller ones?

(12) Which size of buildings has the lower cost per pupil?

15. How many gallons of water does a tank hold, that

measures 6 ft. by $4\frac{1}{2}$ ft. by $5\frac{1}{2}$ ft.? One cubic foot contains $7\frac{1}{2}$ gallons of water.

16. What is meant by capacity?

17. (a) A cubic foot of water weighs $62\frac{1}{2}$ lb. and ice is about .9 as heavy as water. What does a cubic foot of ice weigh? (The ratio of .9 is only approximate, but is accurate enough for our use. A more exact statement is that ice weighs .9166 times as much as water at 4° Centigrade.)

(b) What is the capacity of the ice chamber of a refrigerator that measures $24'' \times 18'' \times 14''$?

Note: Think of a shorter way of solving this problem than by multiplying these dimensions and dividing by 1728.

(c) Get your result correct to the nearest 5 lb.

(d) Take the measures of the ice chamber of your refrigerator and find its capacity.

18. (a) On the outside of most freight cars are printed the inside measurements. Let a committee of boys find the measures of a number of cars and bring them to class.

(b) Compute the capacity of these cars.

(c) Some cars may be filled with coal. Therefore, we must know the weight of a cubic foot of coal. A number of states have laws that fix the number of pounds of various commodities in a bushel. Most states that have such laws, require 80 lb. of anthracite coal to a bushel. Kentucky, however, requires only 76 lb.

(d) How many cu. ft. are in a bushel?

(e) How many pounds of anthracite coal are in a cu. ft.? How many according to the Kentucky laws?

(f) The number varies from 90 to 100 pounds of coal in a cu. ft. How many cu. ft. in a ton of coal?

(g) Find the number of tons of coal in the coal cars whose measures you found.

19. (a) Where is the great wheat belt of America?

(b) Find out something of the number of cars of wheat that pass through Winnipeg, Canada, each day during the two or three months after the harvest.

(c) How many bushels of wheat does an ordinary freight car contain?

(1) How many cu. ft. equal 1 bu.?

(2) How many bu. are in 1 cu. ft.?

(d) How many bushels are shipped daily, on an average, during the summer, from Winnipeg?

(e) How much does a bushel of wheat weigh? (See table in Appendix.)

(f) How many tons of wheat does a car contain?

(g) How many tons are shipped daily at Winnipeg?

20. (a) Make up ten practical problems about volume or capacity.

(b) Solve your own or those of a classmate.

21. (a) Using the letter V for volume and e for the edge of a cube, write the formula for the volume of a cube.

(b) If a cube is 2″ on a side, find its volume.

$$\begin{aligned} V &= e^3 \\ &= 2^3 \\ &= 8 \text{ cu. in.} \end{aligned}$$

(c) Find the volume of 4 cubes each 3 in. on a side.

$$\begin{aligned} 4V &= 4e^3 \\ &= 4 \times 3^3 \\ &= 4 \times 27 \\ &= 108 \text{ cu. in.} \end{aligned}$$

(d) Find the volumes of the following cubes:

No.	No. of Cubes	Edge of Cubes	Volume
1	2	3 cm.	.....
2	1	$7\frac{1}{2}$ in.	.....
3	5	$2\frac{1}{4}$ in.	.....
4	3	4.8 cm.	.....
5	8	$2\frac{3}{8}$ in.	.....
6	6	$1\frac{1}{2}$ ft.	.....
7	1	6.5 cm.	.....
8	4	8.3 cm.	.....
9	10	1.25 in.	.....
10	1	$2\frac{7}{8}$ in.	.....

22. (a) Using the letter V for volume, and the letters l, w, and h for the three dimensions, write the formula for the volume of a rectangular prism.

(b) From the given dimensions, find the volumes of the following prisms.

No.	l	w	h	V
1	4.5 cm.	2.5 cm.	3	.....
2	$8\frac{1}{2}$ cm.	$6\frac{1}{2}$ cm.	5″	.....
3	15 ft.	6 ft.	1 ft.	.....
4	12 yd.	$5\frac{1}{2}$ yd.	$\frac{1}{4}$ yd.	.....
5	1.6 in.	.8 in.	.75 in.	.....

QUESTIONS AND PROBLEMS

QUESTIONS

CHAPTER ONE

1. (a) What are your two goals for achievement in calculation?
   (b) Why should you strive for them?
2. Of what use are graphs?
3. (a) What is an integer?
   (b) A fraction?
   (c) A mixed number?
4. (a) Name and define the terms of a fraction.
   (b) Explain how the terms of a fraction may be changed without changing the value of the fraction.
5. (a) What is a proper fraction? An improper fraction?
   (b) Explain how an improper fraction may be changed into a whole or a mixed number.
   (c) When will the change result in a whole number? When, in a mixed number?
6. (a) What is a prime number?
   (b) What is a factor of a number?
   (c) What is a prime factor?
   (d) Illustrate each.
7. Describe and explain the process of addition of fractions.
8. (a) What are common fractions?
   (b) What are decimal fractions?
9. (a) What names are given to the numbers in a problem in subtraction?
   (b) Define each.
10. (a) How do you check addition?
    (b) How do you check subtraction?
11. What is the square of a number?
12. (a) What names are given to the numbers in a problem in multiplication?
    (b) In division?
    (c) Define each.
13. Explain how you can find mentally the product of two numbers, whose difference is 2, provided you know or have access to a table of squares.

14. (a) Explain the best methods of checking multiplication.
    (b) Of checking division.
15. Explain the following short cuts in multiplication:
    (a) Multiplication of integers and decimals by 10, 100, 1000, etc., and by their multiples.
    (b) Multiplication by 25.
    (c) Multiplication by 11.
    (d) Squaring any number ending in $\frac{1}{2}$, .5, or 5.
16. (a) What is supplementary multiplication?
    (b) How may it be used as a short cut?
17. (a) What is complementary multiplication?
    (b) How may it be used as a short cut?
18. (a) What are the common aliquot parts of a dollar?
    (b) What is the test for knowing which should end in halves? In thirds?
19. (a) How may a common fraction be changed to a decimal form?
    (b) What is the test for knowing whether or not such a fraction can or cannot be changed to an even decimal?
20. (a) Give the test for knowing whether or not a number is divisible by 2.
    (b) By 3. (c) By 4. (d) By 5.
    (e) By 6. (f) By 8. (g) By 9.

PROBLEMS

CHAPTER ONE

1. Estimate the daily time spent in the following activities and make a bar graph to indicate your average daily program: sleeping, care of person (as eating, dressing, etc.), work, study, recreation, general reading, miscellaneous activities.

Add and check, using two methods alternately:

2.	3.	4.	5.	6.
568	792	695	50	658
932	837	63	375	750
556	93	250	379	871
374	585	375	87	536
159	798	97	645	862
731	695	298	521	784

7.	8.	9.	10.	11.
8563	8894	1234	5872	1978
9872	4867	3313	4950	5132
5649	2315	5962	3842	6799
3342	1260	1694	7936	3200
8758	3542	2654	5491	4967
7964	7698	3965	1573	7327

12. Make and solve a problem in horizontal addition.

13. Add:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
$\frac{3}{5}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{2}{9}$	$\frac{5}{6}$	$\frac{7}{8}$	$\frac{5}{16}$	$\frac{2}{3}$
$\frac{3}{8}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{10}$	$\frac{1}{4}$	$\frac{5}{8}$

14. Add the following without using a pencil:

(a)	(b)	(c)	(d)	(e)
$7\frac{1}{2}$	$8\frac{1}{5}$	$10\frac{7}{8}$	$6\frac{1}{4}$	$3\frac{9}{10}$
$2\frac{2}{3}$	$4\frac{2}{7}$	$5\frac{1}{2}$	$9\frac{1}{5}$	$7\frac{3}{4}$

(f)	(g)	(h)	(i)	(j)
$3\frac{1}{4}$	$6\frac{2}{3}$	$7\frac{2}{9}$	$8\frac{1}{5}$	$9\frac{1}{6}$
$5\frac{1}{2}$	$7\frac{3}{8}$	$3\frac{1}{3}$	$6\frac{1}{10}$	$2\frac{1}{5}$

15. Add:

(a)	(b)	(c)	(d)
3.875	8.924	17.34	8.42
2.50	9.376	19.87	7.16
.97	3.792	4.92	52.185
7.43	.426	7.68	4.32
8.649	19.234	6.49	9.72
5.872	8.762	8.43	5.16

16. Subtract:

(a)	(b)	(c)	(d)	(e)	(f)
15.187	27.923	$569\frac{1}{4}$	92.526	23.42	$74\frac{1}{6}$
4.109	8.069	$327\frac{2}{3}$	18.429	17.083	$9\frac{2}{3}$

(g)	(h)	(i)	(j)	(k)	(l)
324.625	42.87	36.05	93.79	527	21′ 3″
120.843	13.246	12.875	42.18	49.68	4′ 9″

17. Write the following products:

(a) $3.5 \times 3.5 =$
(b) $6\frac{1}{2} \times 6\frac{1}{2} =$
(c) $55 \times 55 =$
(d) $11.5 \times 11.5 =$
(e) $(13\frac{1}{2})^2 =$
(f) $(75)^2 =$
(g) $(8.5)^2 =$
(h) $(4\frac{1}{2})^2 =$

18. Use supplementary multiplication or complementary multiplication as needed to find the following products:

(a) 118×105
(b) 96×91
(c) 89×93
(d) 114×109
(e) 126×130
(f) 91×88

19. Which short cuts should be used in each of the following problems? Write the products:

(a) $\$3.98 \times 400$
(b) $7\frac{1}{2} \times 7\frac{1}{2}$
(c) 3847×11
(d) 7.64×25
(e) 28×26
(f) 113×102
(g) 55^2
(h) 96×93
(i) $(11\frac{1}{2})^2$
(j) 19×17
(k) $\$.87\frac{1}{2} \times 144$
(l) $5.688 \times 16\frac{2}{3}$

20. Estimate the following quotients. Then find the exact quotients and checks:

(a) $726.43 \div 13.6$
(b) $36.26 \div 1.5$
(c) $97.384 \div 6.9$
(d) $68.92 \div .023$

21. A Saturday grocery list was \$5.25. A ten-dollar bill is given to the clerk. How much change should be received?

22. Herman bought at a drug store the following: a tooth brush for 65¢, soap for 10¢, and medicine for 37¢. He gave

the clerk a five-dollar bill. The clerk gave Herman a one-dollar bill and 3 cents in change. Was this correct? Who lost in the transaction and how much?

23. Viola buys some lace at 10¢ a yard. How much will she pay for $25\frac{1}{2}$ yards?

24. A dozen glass jars cost 90 cents. The tin cans cost 40 cents. How many times more expensive are the glass jars?

25. George paid for his lunches one week: 23¢, 19¢, 26¢, 25¢ and 20¢. Find the total cost.

26. Bernard measured his mother's kitchen and found it to be 14′ x 12′. How many square yards of linoleum are needed to cover it?

27. Jane and her mother bought $2\frac{1}{4}$ yards of goods at 36¢ a yard. How much change should be received from a $5 bill?

28. Marcella's father bought a $495 piano. How long will it take him to pay for it if he pays $75 cash and $24 a month?

29. Some seventh grade pupils solved 40 problems every other day for 2 weeks. Each one kept a record of the number of minutes used each time in solving the problems. Make a line graph of these records.

Name	Mon.	Wed.	Fri.	Mon.	Wed.	Fri.
Albert	54	50	46	43	42	40
Fred	45	39	26	30	28	23
Dorothy	40	34	35	35	37	40
Henry	60	50	53	45	45	47
Travis	65	35	48	40	30	30
Lucile	60	55	50	45	35	25
Katherine	40	35	30	34	28	30
George	45	30	35	30	28	27
Louise	60	40	40	25	24	18
Verna	45	43	35	32	31	33

30. Make bar graphs of the above records. Which do you like better, the line graphs or the bar graphs? Why?

31. (a) Make line graphs of the following ages of pupils in

a seventh grade arithmetic class.

(b) Make line graphs of their weights.

(c) Make line graphs of their heights.

(d) Make bar graphs of the same.

Name	Age	Weight in lbs.	Height in in.
Katherine	11	88	57
Thomas	13	108	63
Eleanor	11	85	57
Verna	12	75	56
John	12	89	58
Henry	15	110	63
William	14	107	62
Dorothy	11	83	57
Edward	13	84	55
Stanley	11	80	54
Eva	15	102	62
Mason	12	86	61
Melvin	12	79	53
Bernard	11	90	59
Viola	14	104	63
Hilda	12	98	61
Lucile	12	78	60
Dorothy	12	71	50
Julia	11	99	62
Ruth	12	75	55
Clarence	13	83	56
Eugene	14	101	61

32. The electric light bills of a family for a year are given below. Make a line graph of them.

January	$3.50	July	$ .50
February	4.00	August	.50
March	4.25	September	.98
April	3.98	October	1.12
May	2.50	November	3.50
June	.63	December	3.00

33. The gas bills of a family for a year are given below. Make a line graph of them.

January	$5.05	July	$4.50
February	4.05	August	.90
March	3.15	September	1.80
April	4.50	October	2.25
May	3.60	November	6.15
June	4.05	December	7.25

34. Hilda's spelling grades in per cents for two weeks are the following:

	Mon.	Tues.	Wed.	Thur.	Fri.
First week	85	70	90	100	60
Second week	60	70	80	90	100

(a) Make the graphs of these grades.

(b) Compare them.

35. Make a line graph and a bar graph of the money Dorothy saved in one week.

Monday	$ .20	Friday	$1.00
Tuesday	.25	Saturday	.90
Wednesday	.40	Sunday	2.00
Thursday	.60		

36. The following table shows the relative percentages of total school enrollment in the senior high school grades (10, 11, and 12) in 23 cities of over 100,000 population. Seattle leads with 16 per cent. Make bar graphs of these percentages.

Cities	Percentage of Enrollment
Seattle	16
San Diego	15.2
Spokane	15
Minneapolis	14.1
Tacoma	14.1
Portland, Ore.	13.3
Cambridge	13
Des Moines	12.8
Omaha	12.5
Washington, D. C.	12.4

Cities	Percentage of Enrollment
Columbus	12.3
Dayton	12
Denver	12
New Haven	12
Indianapolis	11.8
Paterson	11.2
St. Paul	11
Worcester	10.6
Los Angeles	10
Rochester	10
Louisville	9.9
Trenton	9.8
San Francisco	9.7
Salt Lake City	9.6
Detroit	9.4
Cincinnati	9
Reading	8.8
St. Louis	8.6
Wilmington	8.3
Newark	7.4
Philadelphia	7.1
Baltimore	7

37. A white potato is composed of 1.8% protein, .1% fat, 14.7% carbohydrates, .8% ash, 62.6% water, and 20% refuse. An egg is composed of 14.8% protein, 10.5% fat, 1% ash, and 73.7% water.

(a) Make bar graphs showing these parts.

(b) How many times more protein is there in the egg than in the potato?

(c) How many times more fat?

(d) How much more water is in the egg than in the potato?

(e) How do your graphs show these facts?

38. James's father owes \$170.80, \$56.48, \$46.05, and \$187.42. Did he owe more or less than \$500? If he pays \$75 a month on his debt, how long will it take him to pay it?

39. Estimate the cost of 16 dozen eggs at 37 cents a dozen.

40. Put the decimal points in the right places:

(a) $62.25 \times 2.04 = 1269900$

(b) $1.414 \times 3.5 = 49490$

(c) $29.47 \div 7 = 421$

(d) $25.079 \div 3.1 = 809$

41. If a foot of copper wire costs 3¢, how much will 3 yards cost?

42. If a house costs \$14,000, how much would a man make if he sold it for \$16,000 after spending \$658 on repairs?

43. (a) What is a short way to multiply by 25?

(b) Multiply the following.

(1) 417.4×25 (3) 89.92×25

(2) 321.8×25 (4) 734.1×25

44. Multiply, using a short cut.

(a) 4836×100 (f) 102×118

(b) 143.4×25 (g) 94×98

(c) 75×75 (h) $(6\frac{1}{2})^2$

(d) 32.80×11 (i) 38.6×1000

(e) 76×74 (j) $82.16 \times 16\frac{2}{3}$

45. A field is 400 feet long and 200 feet wide. What is the distance around it?

46. Write the following squares:

(a) 14^2 (g) 28^2 (m) 21^2

(b) 15^2 (h) 17^2 (n) 26^2

(c) 29^2 (i) 30^2 (o) 22^2

(d) 16^2 (j) 19^2 (p) 13^2

(e) 20^2 (k) 27^2 (q) 23^2

(f) 24^2 (l) 18^2 (r) 25^2

47. Multiply by short method and check the following:

(a) 13×15 (j) 18×22

(b) 14×16 (k) 26×28

(c) 28×30 (l) 17×19

(d) 15×17 (m) 26×22

(e) 19×21 (n) 25×27

(f) 23×25
(g) 27×29
(h) 16×18
(i) 29×31
(o) 21×23
(p) 12×14
(q) 22×24
(r) 24×26

48. (a) Estimate the following results.
(b) Write the exact results.

(1) $83.6 \div 10$
(2) $842 \div 100$
(3) $90769 \div 1000$
(4) $469 \div .1$
(5) $768 \div .01$
(6) $1453 \div .001$
(7) $678 \div 10$
(8) $598 \div 100$
(9) $697 \div 1000$
(10) $3597 \div 1$
(11) $258 \div .01$
(12) $49.28 \div .001$

49. Divide the following in the shortest way possible:

(1) $42600 \div 200$
(2) $8720 \div 500$
(3) $492 \div 25$
(4) $824 \div 12\frac{1}{2}$
(5) $385 \div 33\frac{1}{3}$
(6) $245 \div 16\frac{2}{3}$
(7) $378 \div 200$
(8) $569 \div 500$
(9) $248 \div 25$
(10) $392 \div 12\frac{1}{2}$
(11) $27 \div 33\frac{1}{3}$
(12) $792 \div 16\frac{2}{3}$

50. (a) Write the results of the following.
(b) Check by solving each.

(1) $\frac{1}{3} + \frac{1}{5}$
(2) 27×27
(3) 28×32
(4) 49×10
(5) 87×100
(6) 483×1000
(7) 769×300
(8) 875×25
(9) 1453×11
(10) $8\frac{1}{2} \times 8\frac{1}{2}$
(11) 114×102
(12) 105×103
(13) 97×93
(21) $892 \times 37\frac{1}{2}$
(22) $179 \times 8\frac{1}{3}$
(23) $2375 \div 10$
(24) $87690 \div 100$
(25) $32568 \div 1000$
(26) $8729 \div .1$
(27) $56.92 \div .01$
(28) $4936 \div .001$
(29) $7960 \div 200$
(30) $879 \div 500$
(31) $3270 \div 25$
(32) $476 \div 12\frac{1}{2}$
(33) $897 \div 33\frac{1}{3}$

(27) (14) 92×87	(34) $6745 \div 16\frac{2}{3}$
(28) (15) $450 \times .33\frac{1}{3}$	(35) $137.42 \div 20$
(29) (16) $872 \times .75$	(36) $8925 \div 40$
(30) (17) $636 \times .16\frac{2}{3}$	(37) $3794 \div 80$
(31) (18) $8436 \times .83\frac{1}{3}$	(38) $972 \div 900$
(32) (19) $875 \times 12\frac{1}{2}$	(39) $758 \div 37\frac{1}{2}$
(33) (20) $462 \times 66\frac{2}{3}$	(40) $264 \div 66\frac{2}{3}$

QUESTIONS

CHAPTER TWO

First Part

1. (a) What are the necessary items on a sales slip?
   (b) What is an extension? A footing?
2. What are the advantages of paying bills by check?
3. (a) What is money?
   (b) What gives it value?
   (c) Compare the stability of value of the United States dollar with that of the German mark, at present.
4. (a) How should one proceed to open a bank account?
   (b) To cash a check?
5. What are some advantages of keeping statistics in per cents?
6. (a) Why should every business have a budget?
   (b) Why should every family have one?
   (c) Why should every individual have a personal budget?
7. Define and explain the following terms used in business: cost, selling price, gain, loss, per cent of gain, cost of doing business, depreciation, appreciation, discount, wholesale, retail, list prices, commission.

PROBLEMS

CHAPTER TWO

First Part

1. (a) Mr. Kennedy, with $8000 capital, decides to open a book store. His sales for the first month are $2000. The total cost of the books sold are $1400. What is his gross profit?
   (b) His expenses are as follows:

Rent	$ 75
Salaries for 4 clerks	200
Salary for himself	200
Delivery boy	10
Miscellaneous expenses	50

What is his net profit?

(c) What part of his total sales is spent on rent? On salaries for his clerks? On the delivery boy? On the miscellaneous expenses? What part of his sales is his profit?

(d) What per cent is each of the above parts?

2. (a) One of Mr. Kennedy's friends opens an electrical shop with a capital of $2500. His sales for the first month are $3000. The cost of the goods sold is $1300. His expenses are as follows:

Rent	$200
Advertising	250
Salaries for 3 clerks and 3 mechanics	410
Salary for self	100
Delivery expense	20

(b) What is his net profit?

(c) Which man made the better investment, the dealer in books or in electrical supplies?

3. A college bred man or woman has many more chances than the non-college bred person to achieve distinction in his line. For an artist the chances are 44 compared to 15. Make two bar graphs for the purpose of making the comparison. The chances for distinction in other professions or occupations are shown in the following table. On one chart, make a set of bar graphs for each.

Author	55 to 21
Business man	62 to 3
Clergyman	49 to 6
Congressman	53 to 13

Editor	46 to 19
Engineer	55 to 11
Lawyer	57 to 5
Physician	56 to 11
Musician	54 to 34
Sailor	59 to 7
Scientist	44 to 31
Soldier	64 to 7
Statesman	55 to 9

4. (a) What is the per cent of profit on the sale of Remigton typewriter if the cost is $35 and the selling. price $50.

(b) A boy who is working his way through college buys 5 rebuilt Underwood typewriters for $150 and sells them for $50 each. What is his per cent of profit?

(c) If he sells a typewriter for $100 and gives a discount of 5% for cash, how much does he make if the machine cost him $65? What is his per cent of profit?

(d) If he sells 5 typewriters for $100 each on a commission of $17\frac{1}{2}\%$, how much does he earn?

5. A man bought a house for $4700. He made $500 worth of repairs. What was the total cost of the house? He sold it at a gain of 18%. What was the selling price?

6. A real estate agency pays a 3% commission on all property sold. During one month an agent sold $4675 worth of property the first week; $2000, the second week; $7500 the third; and $1500 the fourth. What were his commissions for the month?

7. If the cost of doing business in a drug store is 35% and if the first cost of the goods is 30%, how much would a druggist clear if his business amounted to $650 a month?

8. (a) A grocer wishing to make a profit of 20% buys at the following prices per cwt.:

Sugar	$ 9.00
Coffee, best grade	36.00
Coffee, 2d grade	30.00
Coffee, 3d grade	25.00
Lard	10.00
Wieners	18.00

(b) Find the selling price of each per pound.

(c) Check your results.

9. Real estate firms now receive 4% commission for selling. One firm sold the following properties in one month of March:

March 5,	Residence	$ 5,500
8,	Apartment	22,000
12,	Business block	180,000
17,	Residence	7,000
25,	Factory	18,000

What is the commission on each? The total commission? Have you checked your answers?

10. Furniture is listed in catalogue at the following prices:

Davenport	$280
Rocker	60
Fireside chair	50
Bedroom suite	225
Dining-room chairs	140
Table	80

The terms are 40% off with an additional 2% off for cash. Find the cash price of each. How may you check your results?

11. Louise spent 27 minutes on her home work in arithmetic. What part of an hour was this?

12. Paul's baseball team played 50 games and won 32. What per cent of the games played did his team win?

13. If $3\frac{1}{2}\%$ milk costs 35¢ a gallon, what is 5% milk worth?

14. Make out sales slips for the following purchases:

(a) round steak ..... $ .40
5 lb. sugar ..... @ .11
½ doz. lemons ..... @ .40
navy beans ..... .25
1 can peas ..... .18
1 can Crisco ..... .27

(b) 1 boy's cap $1.00
1 necktie ..... .50
1 girl's sweater 6.50
4 yds. gingham ..... @ .45
2 spools thread ..... @ .05
1 doz. buttons ..... .10
bias binding ..... .10

15. (a) Make out a monthly statement for the following:
(b) Write a check in payment of this bill.
(c) Properly endorse the check.
(d) Why is a receipt not necessary?

1 man's suit $45
1 white shirt 5
1 man's hat 5
2 pairs socks 1

16. (a) Make a monthly statement for the following:
(b) If the customer gives a 10-dollar bill in payment of this, how much change will be received?
(c) Receipt the statement.

1 toy aeroplane $2.50
1 book 1.25
6 handkerchiefs ..... @ .15
1 sewing basket 1.75

17. Make out a deposit slip for the following:
currency $5.00, silver $2.00, check for $150, check for $15.

18. A grocer had a balance of $570.40 on the first of the month. He deposited $42.50, $136.50, and $96.72, and

gave checks for $76.92, $48.71, and $261.56. What was his balance then?

19. Mrs. Garrison paid her rent of $30 in cash. Make out a receipt for her, as if you were the owner.

20. A bookkeeper had such a long column of cash received to add that he divided it into the three shorter columns below. Foot each column and then find the total of these footings.

(a)	(b)	(c)
$2000.00	$ 45.00	$82.40
20.00	95.00	8.00
5.00	40.00	48.60
100.00	75.00	10.00
22.00	10.00	7.00
50.00	51.50	10.00
19.50	165.60	25.00
5.00	15.00	12.50
15.00	10.00	15.00
21.40	16.50	17.50
52.48	65.00	20.00
52.50	150.00	75.00
18.50	30.00	

21. (a) The bookkeeper had the following casn payments for one month.

(b) Find the total for the whole month.

(a)	(b)
$200.00	$ 5.00
540.00	950.00
37.50	25.00
25.00	37.50
37.50	30.00
30.00	25.00
25.00	10.00
10.00	5.00
5.00	25.00

48.50	20.00
125.00	25.00
25.00	37.50
37.50	30.00
30.00	25.00
25.00	10.00
10.00	5.00

22. (a) How can you find the balance at the end of the month if you have the total receipts from problem 20 and the total payments from problem 21?

(b) Find the balance.

(c) Add the balance to the total payments.

(d) How does this sum compare with the total receipts?

23. The total capital of the banks of a city is shown in the following table.

(a) What is the total capital?

(b) What is the total surplus and profits?

(c) What is the total deposits?

(d) What per cent of the total deposits were the deposits of the Ohio National Bank?

Banks	Capital, March 31, 1924	Surplus and Profits, March 31, 1924	Deposits, March 31, 1924
Brunson Savings	100,000	18,488	991,247
Citizens' Trust	1,500,000	719,610	23,735,679
City National	300,000	561,742	5,783,634
Columbus National	500,000	61,246	2,109,717
Columbus Savings	50,000	107,129	1,234,608
Commercial National	600,000	997,307	9,415,963
Commonwealth Savings	100,000	40,552	515,632
Fifth Avenue Savings	100,000	80,888	1,694,823
First National	500,000	689,976	10,276,530
Huntington National	1,500,000	1,470,744	22,502,960
Market Exchange	100,000	230,984	3,410,994
National Bank of Commerce	300,000	681,405	4,701,909
Northern Savings	100,000	26,235	1,005,950
Ohio National	1,000,000	2,163,511	20,319,954

24. In 1913 the national wealth was \$184,491,508,918 and \$521,546,000 was spent on schools.

(a) What is the national wealth in round numbers?
(b) What in round numbers was spent on schools?
(c) What is the approximate per cent of the nation's wealth spent on schools?
(d) Is this enough for the 110,000,000 people of the United States to spend on schools?

25. In 1923 the national wealth was \$318,453,865,000 and \$1,580,682,187 was spent on schools.

(a) Write each one of these values in round numbers.
(b) What is the approximate per cent spent on schools?
(c) When we realize that the purchasing power of the 1923 dollar is only 57¢ as compared with \$1.00 in 1913, is this any increase?

26. A merchant bought 1000 yards of cloth for \$230. He is allowed a discount of 20%. How much did he pay per yard?

27. Katherine's mother bought a \$55 sweeper for \$43.50. How much did she save? What per cent did she save?

28. Myrtle's mother bought a \$90 electric washer for \$70. What was the discount? What was the per cent of discount?

29. Earl's father bought an automobile for \$1250 and sold it for \$1000. What was the reduction? What was the per cent of reduction?

30. The K. B. Black Co. bought 150 dresses at \$7.50 apiece and sold them for \$9.85. What was the gain per cent?

31. In a sale a \$39.50 desk was sold at a discount of 10% and a cabinet marked \$75.00 at a discount of 16%. What was the selling price of both together?

32. Paul received \$30 as a birthday gift to spend as he pleased. He bought a small radio set for \$15.00 and a football for \$2.50. He put the rest in a savings bank. How

much did he put in savings bank? What per cent did he put in the bank?

33. Joe's father sold automobiles at a salary of $150 per month and a commission of 3% on all he sold above $4000. One month he sold three machines at $1475, $2200, and $3000. What was his income that month?

34. A merchant paid $12 a barrel for flour and sold it at $7\frac{1}{2}¢$ a pound. Find the gain per cent.

35. A farmer sold 2 car loads of hogs. Each car contained 75 hogs. The average weight of the hogs was 300 lbs. The price was $8.20 per cwt. How much did he receive for the hogs if he had to pay a commission of $1\frac{1}{4}\%$?

QUESTIONS

CHAPTER TWO

Second Part

1. What is interest and what is its importance in business?
2. Upon what three variable factors does the amount of interest depend?
3. What would be your attitude toward an investment that claimed to make 40% interest on your money invested? Why?
4. What is the difference between a commercial account and a savings account in a bank?
5. Explain the difference between simple interest and compound interest.
6. Explain the following terms used in business: principal, rate of interest, mortgage, note, face of the note, judgment note, amount, periodical investment table, rate of taxation, premium.

PROBLEMS

CHAPTER TWO

Second Part

1. A boy lends his brother $1250 to finish his college education. At the end of $7\frac{1}{2}$ years the brother pays this loan at 5% interest. How much is the interest? The amount?

2. Find the interest when the principal is $2300, the rate $4\frac{1}{2}\%$, and the time 120 days.

3. On September 1, 1923, \$450 is borrowed for 90 days at 6%. What is the interest? On what date should the principal be paid?

4. On January 25, 1923, a man wishes to borrow \$600 for 30 days. If the rate is $5\frac{1}{2}\%$, what will the interest be? On what date will the principal be due? What amount is due at that time?

5. Make an outline showing how the interest on \$4690 for 17 days at 6% may be found by using an interest table.

6. How much money must a man save to put into a business paying 6% to bring in an income of \$4500?

7. At what rate must I lend \$3500 to produce \$157.50 a year?

8. What is compound interest?

If you spend 50 cents a week on luxuries, how much is so spent in a year. If, instead, you put this amount in a savings bank for 5 years at 4% interest, what will the amount be at the end of that time?

9. A man has a home worth \$7500. How much tax does he pay if the tax rate is 2.5%? If the city votes to have a $\frac{1}{2}$ mill increase, how much will his taxes be? Why should he be glad to pay this additional tax?

10. A home worth \$8000 is insured for 80% of its value at the rate of 75 cents per hundred for a period of five years. How much is the premium?

11. Fill in the blanks:

Date of Loan	Amount Borrowed	Time of Loan	Rate of Interest	Interest Paid	Date Prin. is Due
Feb. 3, 1921..	\$560	60 da.	$5\frac{1}{2}\%$		
Mar. 21, 1920..	350	90 da.	6 %		
June 28, 1920..	475	30 da.	$6\frac{1}{2}\%$		
Dec. 10, 1921..	850	90 da.	$6\frac{1}{2}\%$		

12. (a) A man wishes to have a regular income of \$2500

per year. If he can get 6% interest, how much money will he have to invest?

(b) If he were able to get 8% interest, how much would he have to invest?

13. A man owns two houses. One is valued at \$8500, the other at \$10,000. At the present rate of taxation, how much taxes must he pay on each?

14. A man filled out his personal tax returns as follows: household goods, \$400; books, \$300; jewelry, \$150; automobile, \$1200; money in bank on checking account, \$200. He is entitled to \$100 exemption. If the tax rate is \$2.55 per \$100, what are his taxes for the year?

15. A house valued at \$5000 is insured for $\frac{3}{4}$ of its value at the rate of \$ .75 per \$100. What is the premium for a 3 yrs. policy? If the property is destroyed before the policy expires, how much will be his loss?

16. Elizabeth's father estimated his household goods at \$900. He decided to insure them for \$800. The rate of insurance for a three-year period was \$1.02 per hundred. Find his insurance.

17. Find interest on \$75 for $4\frac{1}{2}$ yrs. at $5\frac{1}{2}$%.

18. Find interest on \$4500 for 96 days at 7%.

19. On January 3, 1924, a man borrows \$2000 from a friend and agrees to return it at the end of 90 days with 6% interest. Find the date he must return money and amount he must pay.

20. A typewriter dealer bought a shipment of Remington typewriters on July 15th. The agent gave him his choice of the following terms on his invoice of \$1500:

5% off for cash.
3% off if paid within 30 days.
2% off if paid in 60 days.

If he pays the bill under 90 days, he must borrow the amount needed from the bank at 6% interest. Under which of the terms can he save the most and how much?

21. Using the proper table find the interest on \$2145 for 21 days at 4%.

22. If the rate of interest is $6\frac{1}{2}\%$ and the income is \$42,250, what is the principal?

23. If the interest in one year amounts to \$264 and the principal is \$4800, what is the rate?

24. Find the amount of \$1000 for 2 yr. at 4% if the interest is compounded quarterly.

25. Using the table on page 129, find the amount of \$450 for 11 yrs. at 5%, the interest being compounded semi-annually.

26. Using the table on page 132, answer the following: If you begin saving when you are 10 years old and save \$30 a year, receiving 4% interest, compounded annually, how much will you have when you are 30 years old?

27. (a) Ralph wishes to borrow money from his father to buy a radio set.

(b) How much should he borrow if he needs the following?

(c) What amount will he give from his earnings to his father at the end of $2\frac{1}{2}$ years if he decides to pay 5% interest?

Cabinet	\$ 5.00	Storage battery	\$ 2.00
Tubes	22.50	"B" batteries	12.00
Rheostats	1.00	Magnavox	29.00
Audio transformer	15.00	Jacks	2.50
Binding post	.50	Plugs	4.00
Coil	15.00	100 ft. aerial wire	.50
Sockets	1.50	Ground wire	.25
Grid leak and condenser	.79	Insulator	.10
		Wall insulator	.10
Phone condenser	.39	Lightning arrester	.75
Copper coil	.30	Connecting block	.25

28. Find the missing terms:

	Principal	Rate of Interest	Time	Interest
(a)	$ 200	4½%	90 days	$.....
(b)	150	.....	1 year	6.00
(c)	....	5%	1 year	23.00
(d)	....	2½%	60 days	1.50
(e)	800	.....	1 year	15.00
(f)	425	6%	1 year, 3 mo.	.....
(g)	350	.....	1 year	14.00
(h)	....	4%	1 year	31.00
(i)	950	5%	1 year	.....
(j)	530	.....	1 year	15.90
(k)	600	6%	60 days	.....
(l)	....	4%	1 year	48.00
(m)	2500	.....	1 year	125.00
(n)	....	4½%	1 year	67.50
(o)	7000	7%	2 years	.....

29. (a) If Ralph puts $400 in a savings bank when he is 12 years old, how much will he have when he is 18, if the bank pays 5%, compounded semi-annually?

(b) What kind of table helps to solve this problem?

30. If Charles begins saving for his college expenses when he is 6 years old and saves $120 a year, receiving 4% interest, compounded annually, how much will he have when he is 18 years old, or ready to go to college?

31. (a) A ten-year-old cow gave 32,294 pounds of milk and 1052 pounds of butter fat in a year, according to the registry department of the Holstein-Friesian Association of America.

(b) What per cent of the milk was the butter fat?

(c) What was the selling price of the butter fat at 30¢ a pound?

(d) If this amount were put in savings bank that paid 5%, compounded semi-annually, how much would it grow to be in 5 years?

32. (a) Ruth's father bought a car for $2200 and paid $1000 down.

(b) He signed 10 notes for the rest of it at 7% interest.
(c) Write the notes.
(d) How much interest did he pay altogether?

QUESTIONS

CHAPTER FOUR

1. Why should every one keep personal accounts?
2. (a) What is the use of the cash book?
   (b) Describe its form.
   (c) What is meant by an account being in balance?
3. (a) What is the use of a ledger?
   (b) Describe its form.
4. What is a trial balance?
5. What is a profit and loss statement?
6. Distinguish between gross profits and net profits.
7. (a) Explain the use of a purchase book.
   (b) A sales book.
8. What are accounts receivable?

QUESTIONS

CHAPTER FIVE

1. What does the word *measure* mean to you?
2. What are some of the practical uses of measurements?
3. (a) What are approximate measurements?
   (b) When should they be used?
4. To what extent should measurements be exact?
5. How are the following measurements made?
   (a) Lengths
   (b) Weight
   (c) Surface
   (d) Capacity
   (e) Volume
   (f) Angles
6. Compare English units of measure with metric units as to:
   (a) Use
   (b) Convenience
7. What is an angle?
8. Discuss the various kinds of angles.
9. Describe a protractor and discuss its uses.
10. What are perpendicular lines?
11. What are parallel lines?
12. To what extent are squares different from rectangles?
13. What is a formula?
14. Discuss its advantages in practical uses.
15. Name and describe as many different figures as you know that are made of straight lines.

TESTS

CHAPTER ONE

Test I-A

MATHEMATICAL PICTURES

1. Fred's arithmetic grades for a week are: Monday 80%, Tuesday 90%, Wednesday 75%, Thursday 95%, Friday 100%. Make a line graph. What does the graph show? If Fred keeps his grades for 4 weeks on the same sheet of paper, how will it benefit him?

2. Beef has 43% water, 15.7% protein, 17.8% fat, 8% mineral matter, and 22.7% refuse. Make a bar graph showing this composition.

3. Edna's lunch expenses for two weeks are the following:

Mon.	Tues.	Wed.	Thurs.	Fri.
40¢	35¢	30¢	25¢	26¢
20	25	15	23	25

Make a graph of expenses for each week.

4. Compare the two graphs.

Test I-B

ADDITION AND SUBTRACTION

1. Add and check:

\$78.62
50.13
17.61
58.72
37.39

2. Subtract and check:

897
258

3. Add:

11.90
7.39

4. $\frac{3}{4} - \frac{2}{5}$

5. $5\frac{3}{4} + 6\frac{1}{2}$

Test I-C

MULTIPLICATION AND DIVISION

1. 82.65×427
2. $8\frac{1}{2} \times 9\frac{1}{4}$
3. $2\frac{5}{8} \div \frac{3}{4}$
4. $86792 \div 3.1416$
5. $5 \div 1.41421$

Test I-D

EVERYDAY PROBLEMS

1. Charles' grades in arithmetic for a week were as follows: Monday 100%, Tuesday 85%, Wednesday 95%, Thursday 70%, Friday 90%. Find his average.
2. Herman bought a dozen pencils for 70¢. He sold them to his classmates at as near cost as possible. What did he charge for each?
3. Mary bought $6\frac{1}{4}$ yards of cloth at $2.10 a yard. What did she pay?
4. At 50¢ a foot, how much will 140 feet of fencing cost?
5. At $12\frac{1}{2}$¢ a yard, how much will $18\frac{1}{2}$ yards of lace cost?

Test I-E

COMMON CALCULATIONS

1. $6\frac{1}{2} \times 2\frac{2}{3}$
2. $8\frac{1}{2} + 3\frac{1}{4}$
3. $12\frac{1}{2} \div \frac{2}{3}$
4. $\frac{7}{8} - \frac{1}{4}$
5. $\frac{5}{6} + \frac{2}{3}$

Test I-F

EVERYDAY PROBLEMS

1. If pencils are 60 cents a dozen, how much does one pencil cost?
2. A bicycle costs $33. How long will it take Mary to save money for one if she saves 75 cents a week?
3. Elsie bought the following groceries:

2 cans salmon @	19¢
2 loaves bread @	12¢
2 qt. milk @	12¢
1 lb. butter @	56¢

2 doz. eggs @ ..... 27¢
2 cans peas @ ..... 23¢
1 box cocoa ..... 25¢

How much change did she receive for a $5 bill?

4. Elizabeth buys 4 yards of silk for a dress at $2.65 a yard. What does it cost?

5. Edward is making a radio set which will cost him $50. If he saves 75 cents a week, how long will it take him to save enough to buy all parts for his radio?

Test I-G

Short Cuts

MULTIPLICATION

1. 837×10
2. $\$9.68 \times 100$
3. 845×1000
4. 547×25
5. 679×200
6. 35×35
7. 4693×11
8. 49×51
9. 96×92
10. 108×112

Test I-H

MAKING ESTIMATES

Give estimates of results only:

1. $24 \overline{)8976}$
2. $3.1 \overline{)2874}$
3. 992×49
4. $\frac{3}{8}$ of 5642
5. $37.8 \overline{)7926.50}$

Test I-I

DECIMALS

1. Add the following: 8.92, 4.3, 89.3, 574.745, 5.6
2. Subtract $8.91 from $148.74.
3. Multiply 842.3 by 2.45
4. Divide 743.21 by 34.2
5. Find value of $\frac{25}{.766}$

Test I-J

SHORT CUTS IN PROBLEMS

1. Solve $\frac{33}{2} \times \frac{3962}{3}$
2. If one yard of lace costs $8\frac{1}{2}$ cents, what will $8\frac{1}{2}$ yards cost?
3. Divide 15 by 2, then square result.
4. Find $\frac{1}{2}$ of 9, then square result.
5. An overall manufacturer bought 400 yards of material at 45¢ a yard. What did it cost?

Test I-K

WORDED PROBLEMS WITHOUT NUMBERS

1. If a man knows the cost of one pound of flour, how can he find the cost of a barrel?
2. If a girl knows how long she wants a dish towel, how can she find out how many dish towels can be cut from a bolt of cloth?
3. (a) If a boy is planning to make a radio set, how will he find out the total cost?
   (b) How will he find out how long it will take him to save this amount if he knows how much he can save each week?
4. (a) If Jane knows how many yards of material it takes to make her a dress and knows the price per yard, how can she find the total cost of the goods?
   (b) If she knows the number of inches of braid it takes for one row around the collar and cuffs, how can she find the number of yards for 3 rows?
   (c) How can she find the cost of the braid if she knows the cost per yard?
   (d) How can she find the cost of the entire dress if she knows the cost of the thread, the buttons and a leather belt she will use with it?
   (e) How can she tell how much cheaper this dress will be than one she had priced in a store?

CHAPTER TWO

Test II-A

BUSINESS PAPERS

1. (a) Make out a sales slip for the following:
   (b) How much change will be received if a 5-dollar bill is given the clerk?

roast beef	$ .75
2 lb. peas	.35
1 can tomatoes	.25
$\frac{1}{2}$ doz. bananas	.15
1 doz. eggs	.30
salt	.10

2. Make out a monthly statement for the following:
   3 girl's dresses at $5.95 each
   2 pairs stockings at $ .75 each
   1 boy's suit for $25.00
   1 child's hat for $5.00
   1 pair shoes for $5.50
3. Make out a check for the above statement.
4. (a) Mark the statement paid.
   (b) When is a receipt unnecessary?

Test II-B

BUSINESS PRACTICE

1. Make out a deposit slip for a $5 bill, 2 fifty-cent pieces, and a check for $10. Indorse the check.
2. A business man's rent is $1200 a year. His total income is $24,000. What part of his income is spent on rent? What percent?
3. Make a line graph of James's arithmetic record for a week. On Monday he solved 8 problems out of 10; Tuesday, 7 out of 8; Wednesday, 4 out of 5; Thursday, 16 out of 20; Friday, 15 out of 15.
4. A girl's allowance is $5 a week. Her lunches are $ .14; $ .18; $ .22; $ .25; and $ .20. What part of her allowance is spent on lunches? What percent?
5. (a) Henry bought a radio set for $50. He spent $25 in improvements. What was the total cost? He sold it at a gain of $66\frac{2}{3}\%$ of the cost.
   (b) How much did he gain?
   (c) How much did he sell it for?

Test II-C

THE COST OF DOING BUSINESS

1. Which is the better investment, a business where the sales amount to $35,000 a year and the cost of doing business is 18.2% of the sales or a business where the sales amount to $90,000 and the cost of doing business is 22%?

2. (a) Helen's brother bought Ford for $1,000. During the first year his expenses were as follows:

State license	$ 8.00
Tax	15.00
Garage	60.00
12 tires at $30.00 each	———
Repairs	90.00
Oil, 20 gallons at 30¢ a quart	———
Gasline, 80 gallons at 22¢ a gallon	———

Allow 25% for depreciation.

How much did the car cost him the first year?

(b) If the car ran 8000 miles during the year, what was the cost a mile?

Test II-D

RAPID CALCULATIONS IN FRACTIONS AND PER CENTS

Find the cost of:

1. $2\frac{1}{2}$ lb. of hamburg steak at 25¢ a lb.
2. $3\frac{1}{2}$ lb. of butter at 54¢ a lb.
3. 6 lb. bananas at $7\frac{1}{2}$¢ a lb.
4. 3 oranges at 35¢ a doz.
5. 5 lb. of sugar at $9\frac{1}{2}$¢ a lb.
6. 6 lb. of new potatoes at $8\frac{1}{3}$¢ a lb.
7. $16\frac{2}{3}$% of $360.
8. $87\frac{1}{2}$% of $480.
9. 20% of $15.98.
10. $66\frac{2}{3}$% of $50.

Test II-E

SPECIAL SALES—DISCOUNTS

1. A furniture store gave $\frac{1}{4}$ off in a sale. How much did a $148.50 davenport cost?

2. Dresses that were marked $22.50 were advertised for $10.00. What was the per cent of reduction?

3. Boys' $12.50 suits were selling for $7.65. What per cent was saved?

4. Girls' sandals that were marked $6.95 sold for $4.95. What per cent was saved?

5. After Easter Helen bought a $4.95 hat at a 20% discount. How much did she save? What did she pay for the hat?

Test II-F

WHOLESALE AND RETAIL BUSINESS

1. An English book is listed at 75¢. If the publisher must give a discount of 25% on the list price, and the dealer may add a profit of 10% of the cost, how much does a pupil pay for the book?

2. The wholesale price of loose leaf note books is $1.80 a dozen. If the dealer makes a profit of $33\frac{1}{3}\%$, what is the selling price of each note book?

3. If pencils cost 70¢ a dozen and the dealer wishes to make 20%, how much should he charge for each pencil?

4. Does a grocer make a larger profit on sugar which costs him $9.80 a cwt. and sells for $11\frac{1}{2}$¢ a pound or on bread which costs 9¢ and sells for 12¢ a loaf?

Test II-G

COMMISSION

1. If a real estate agent sells a house for $7200 and charges the owner $3\frac{1}{2}\%$, how much commission does he receive?

2. A girl clerks in a store for $8.00 a week and 2% on all she sells over $100 each day. If her sales average $200 a day, what is her salary for the week?

3. A real estate agent sold a piece of property for $5,000. On half of this amount he received 5% commission and on the other half, $2\frac{1}{2}\%$ How much did he receive?

4. What is the commission on $6,250 at 5%?

5. What is the commission on $12,500 at 5%?

Test II-H

INTEREST

1. Find the interest on $450 at 7% for 60 da.

2. A farmer borrows $2500 at 5% for 1 yr. 3 mo. What is his interest?

3. A boy received $4\frac{1}{2}\%$ interest on \$650 for 10 years. What amount did he have at the end of the time?

4. (a) A man bought a lot for \$2500 and sold it for \$3000. How much did he make?

(b) If he had left his money in the bank at 5%, what would he have made?

Test II-I

FINDING DATES

1. What date is \$250 due if borrowed Nov. 1, 1925, for 60 days?

2. Mary borrowed some money on Jan. 10, 1926, and promised to pay it in 90 days? When did she pay it?

3. John lent \$500 on June 21, 1927, to be paid in 2 years and 4 months. When did he receive it?

4. A senior in the high school borrowed \$25 on June 1, 1924, and promised to return it with interest in 30 days. When did he return it?

Test II-J

INTEREST FROM TABLES

1. Find the interest on \$500 for 26 days at 6%.
2. Find the interest on \$350 for 192 days at 5%.
3. Find the interest on \$6700 for 62 days at $3\frac{1}{2}\%$.
4. Find the interest on \$4680 for 300 days at 8%.
5. Find the interest on \$4680 for 300 days at 4%.

Test II-K

INTEREST PROBLEMS INCLUDING FINDING RATE OF INTEREST AND PRINCIPAL

1. How much money lent at 5% interest will earn \$30,000 a year?

2. At what rate must I lend \$150 to make \$12 interest?

3. The interest on \$7200 is \$432 a year. What is the rate of interest?

4. If a man pays \$225 interest on a mortgage at $4\frac{1}{2}\%$, what is the amount of mortgage?

Test II-L

COMPOUND INTEREST TABLE

1. At 4% interest, compounded annually, how much will $1 amount to in 40 years?

2. How much will $600 amount to in 40 years at the same rate?

3. How much will $100 amount to in 12 years, if the bank pays 5%, compounded semi-annually?

4. Harry saves 25 dollars a year which is half of what he used to spend on luxuries. He puts it in savings bank at 5% interest, compounded semi-annually. How much will it amount to in 15 years?

Test II-M

TAXES

1. (a) Ralph's home is valued at $8000. What is the tax if the rate of taxation is 2.5%?

(b) If the city votes a special school tax of 2 mills extra, what will the rate be?

(c) What will be the amount of the taxes?

2. (a) What tax is paid on $4500 worth of property if the tax rate is $12.50 on $1000?

(b) What would be the tax if the rate were changed to $2.50 on $100?

Test II-N

INSURANCE

1. A $6000 house is insured for 90% of its value at the rate of $ .60 for $100 worth of insurance. How much is the premium?

2. A farmer insured his property for $8000, which is $\frac{3}{4}$ of the real value. He paid at the rate of $ .75 a $100. What premium did he pay for 3 years' insurance?

3. What is the premium on $200,000 worth of property on $\frac{4}{5}$ of its value if the rate is $ .60 a $100.

4. What is the premium on $700 worth of household goods, insured for 5 years, if the rate is $ .90 a $100?

Test II-O

WORDED PROBLEMS WITHOUT NUMBERS

1. (a) If a man buys a house and soon after puts some improvements on it, how does he find the total cost?

(b) If he wishes to sell it at a certain gain per cent of the cost, how does he find out this gain?

(c) How does he find out what to sell it for?

2. (a) If a newsboy buys papers at a certain price and sells them at a higher price, how does he find out what per cent of the cost he gains?

(b) How does he find out what per cent of the selling price the newspaper publisher receives?

(c) How does he find out what per cent of the selling price he receives?

(d) If he sells several dollars worth of papers, how does he find out how much he gains?

3. A man built a house that cost a certain amount. The lot cost another amount. He sold it at a gain of a certain per cent. How does he find the selling price?

4. If a dry goods merchant spends a certain per cent of his sales on advertising, how much does he spend on several thousand dollars worth of business?

5. If a boy knows the marked price of an overcoat and also the per cent of discount, how does he find the sale price?

6. (a) If a girl knows the marked price and the sale price of a piano, how does she find the amount of reduction?

(b) How does she get the estimated per cent of reduction?

(c) How does she get the exact per cent of reduction?

(d) How does she compare the reduction on one piano with that on another?

VOCABULARY TESTS

Explain the meaning of each term:

Test I	Test II
1. average	1. minuend
2. estimate	2. subtrahend
3. graph	3. difference
4. integer	4. total
5. horizontal	5. area
6. sum	6. square
7. numerator	7. product
8. denominator	8. result
9. factor	9. aliquot part
10. decimal	10. prime factor

Test III

1. article
2. wholesale
3. invoice
4. mixed number
5. vertical
6. interest
7. mortgage
8. note
9. community
10. policy

Test IV

1. tax
2. insurance
3. property
4. balance
5. cash book
6. ledger
7. trial balance
8. merchandise
9. initial expense
10. accounts receivable

Test V

1. inventory
2. summary
3. purchase book
4. sales book
5. entries
6. achievement
7. tax duplicate
8. per capita
9. premium
10. linear measure

Test VI

1. check
2. receipt
3. bank
4. money
5. deposit
6. withdrawal
7. teller
8. stub
9. indorsement
10. depositor

Test VII

1. income
2. indebtedness
3. commodities
4. transaction
5. cost
6. gain
7. selling price
8. investment
9. consumer
10. retailer

Test VIII

1. clearing house
2. capital
3. profit
4. per cent
5. budget
6. memorandum
7. creditor
8. depreciation
9. discount
10. net price

Test IX

1. equivalent
2. reduction
3. list price
4. wholesale price

Test X

1. digit
2. dividend
3. divisor
4. quotient

5. retail price
6. commission
7. gross amount
8. business
9. item
10. expenditure

5. divisible
6. excess
7. extension
8. footing
9. sales slip
10. monthly statement

Test XI

1. uniform
2. parallel
3. straight edge
4. measuring unit
5. metric unit
6. centimeter
7. millimeter
8. meter stick
9. squared paper
10. bisection

Test XII

1. vertex
2. protractor
3. perpendicular
4. oblique
5. direction
6. square
7. rectangle
8. perimeter
9. square inch
10. area

Test XIII

1. compass
2. indefinite length
3. intersection
4. angle
5. right angle
6. acute angle
7. obtuse angle
8. straight angle
9. degree
10. minute

Test XIV

1. inch square
2. dimensions
3. diagonal
4. triangle
5. isosceles
6. equilateral
7. circle
8. radius
9. diameter
10. hexagon

Test XV

1. radii
2. cube
3. cubic inch
4. volume
5. rectangular solid
6. capacity
7. excavation
8. perpendicular bisector
9. formula
10. solids

APPENDIX

TABLES

A. Linear Measure for Length

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods = 1 mile (mi.)

1 mi. = 320 rd. = 1760 yd. = 5280 ft. = 63,360 in.

A hand = 4 in., used in measuring the height of horses.

A fathom = 6 ft., used in measuring the depth of large bodies of water.

A knot = 1.15 mi., used in measuring distances at sea.

B. Square Measure for Surface

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

1A = 160 sq. rd. = 4840 sq. yd. = 43,560 sq. ft.

A section = 1 square mile.

A square = 100 square feet, used in roofing, flooring, and painting.

C. Cubic Measure for Volume

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

A cord = 128 cu. ft., used in measuring wood. It is usually a pile 8 ft. by 4 ft. by 4 ft.

D. Measure of Capacity

I. Liquid Measure

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
1 gal. = 231 cu. in.
1 barrel (bbl.) = 31½ gal.
1 hogshead = 63 gal.

In commerce barrels and hogsheads vary in size.

1 gallon of water weighs about 8½ pounds.
1 cubic foot of water weighs about 62½ pounds.

II. Dry Measure for Fruits, Vegetables, and Grain

2 pints = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)
1 bushel = 2150.42 cu. in., or about 1¼ cu. ft.

E. Avoirdupois Weight

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)
100 pounds = 1 hundredweight (cwt.)
1 pound Avoirdupois = 7000 grains.
2240 pounds = 1 long or gross ton, used in weighing coal and ores at the mines.

F. Standard Weights

1 bu. of wheat =	60 lb.
1 bu. of corn, in the ear =	70 lb.
1 bu. of corn, shelled =	56 lb.
1 bu. of oats =	32 lb.
1 bu. of rye =	56 lb.
1 bu. of barley =	48 lb.
1 bu. of white potatoes =	60 lb.

1 bu. of sweet potatoes = 55 lb.
1 bu. of corn meal = 48 lb.
1 bu. of clover seed = 60 lb.
1 bbl. of flour = 196 lb.
1 bbl. of pork = 200 lb.
1 keg of nails = 100 lb.

G. Troy Weight for Jewels and Precious Metals

24 grains (gr.) = 1 pennyweight (pwt.)
20 pennyweight = 1 ounce (oz.)
12 ounces = 1 pound (lb.)
1 pound Troy = 5760 grains

H. Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
365 days = 1 year (yr.)
366 days = A leap year

A business year usually is 360 days or 12 months of 30 days each.

10 years = A decade
100 years = A century

I. Counting

12 things = 1 dozen (doz.)
12 dozen = 1 gross
20 things = A score

J. Paper

24 sheets = 1 quire
20 quires = 1 ream

Paper is usually sold by the 1000 (M), by the 500 (D), or by the 100 (C) sheets.

In practice 1 ream = 500 sheets.
1 quire = 25 envelopes or cards.

K. Arcs of a Circle

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circumference

L. Angles

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
90 degrees = 1 right angle (rt. ∠) or 1 quadrant
180 degrees = 1 straight angle (st. ∠)
360 degrees = 1 perigon

M. United States Money

10 mills = 1 cent (¢)
10 cents = 1 dime
10 dimes = 1 dollar ($)

Approximate Money Equivalents

England — 1 pound (£) = $4.8665 in U. S. gold coin
France — 1 franc (fr.) = 19.3 cents

N. Metric System

I. Linear Measure for Length

10 millimeters (mm.) = 1 centimeter (cm.)
10 centimeters = 1 decimeter (dm.)
10 decimeters = 1 meter (m.)
1 meter = 39.37 inches
1 yard = .9144 meters

II. Square Measure for Surface

100 sq. millimeters (sq. mm.) = 1 square centimeter (sq. cm.)
100 square centimeters = 1 square decimeter (sq. dm.)
100 square decimeters = 1 square meter (sq. m.)
1 square meter = 1.196 square yards
1 square yard = .836 square meters

III. Cubic Measure for Volume

1000 cubic millimeters(cu. mm.) = 1 cubic centimeter (cu. cm.)
1000 cubic centimeters = 1 cubic decimeter (cu. dm.)
1000 cubic decimeters = 1 cubic meter (cu. m.)
1 cubic meter = 1.308 cubic yards
1 cubic yard = .765 cubic meters

IV. Measure of Capacity

1 liter (l) = .908 dry quarts
1 dry quart = 1.1012 liters
1 liter = 1.0567 liquid quarts
1 liquid quart = .94636 liters

V. Measure of Weight

1 gram (g.) = weight of 1 cu. cm. of water
= .0022 pounds
1 pound = 453.59 grams

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